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Issued September 19, 1912.

U. S. DEPARTMENT OF AGRICULTURE
BIOLOGICAL SURVEY—BULLETIN No. 44
HENRY W. HENSHAW, *Chief*

FOOD OF OUR MORE IMPORTANT FLYCATCHERS

BY

F. E. L. BEAL
Assistant, Biological Survey

WASHINGTON
GOVERNMENT PRINTING OFFICE
1912

KINGBIRD

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Biological Survey,
Washington, D. C., April 5, 1912.

Sir: I have the honor to transmit herewith, and to recommend for publication as Bulletin No. 44 of the Biological Survey, a report on the Food of Our More Important Flycatchers, by F. E. L. Beal. As more than 90 per cent of the food of the 17 species discussed in this paper consists of insects, their economic importance is at once apparent. Unfortunately some of the insects taken by flycatchers for food are parasitic and predaceous Hymenoptera, which are to be classed among useful insects. Impartial consideration of the diet of these flycatchers throughout the year, however, leads to the conviction that on the whole the birds do considerably more good than harm, and hence should be protected as allies of the farmer and the horticulturist.

Respectfully,

Henry W. Henshaw,
Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

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FOOD OF OUR MORE IMPORTANT FLYCATCHERS.

INTRODUCTION.

The flycatchers for the most part inhabit the open country, and prefer to live about gardens, orchards, and sparsely timbered hillsides. Several species are not averse to human neighbors and make their nests in the crannies of buildings, while a number of others build in covered sites, such as hollow trees, under bridges, or under the overhanging bank of a stream. Many of the species show a strong liking for the vicinity of water, and are frequently to be found in the neighborhood of streams or pools, and in dry parts of the country every watering trough by the roadside has its attendant flycatcher. This fondness for the vicinity of water doubtless arises from the fact that insects are abundant in such situations. Most of the species are migratory, though some of them within rather narrow limits.

These birds are extremely agile upon the wing, and turn in the air with extraordinary facility, which enables them to catch the flying insects, of which their food largely consists. Their favorite method of feeding is to perch upon a post, stake, or leafless twig, and from this outlook watch for their prey, and then to sally forth and snap the luckless insect in midair, often with a sharp click of the bill and a sudden turn back toward the perch.

One prominent characteristic, which is more or less marked in the whole family of flycatchers, is the pugnacity they display toward crows, hawks, or other large birds. This is especially shown when the intruders come about the nests of flycatchers, when they are attacked with the greatest vigor and driven off. This trait is particularly marked in kingbirds, so that if a pair of them nest in the vicinity of a poultry yard they serve as protectors of the poultry.

Within the limits of the United States there are 31 species of flycatchers; 1 is of accidental occurrence and 8 are of limited distribution and therefore of little economic importance. For the following discussion of the food of flycatchers 3,398 stomachs were examined, belonging to 17 species. Most of them were obtained in the United States, though a few were taken in British America. The animal food in the whole number of stomachs averages 94.99 per cent and the vegetable 5.01 per cent. In the following table the species are arranged in the order of the amount of their animal food. As some of the species are represented by a comparatively small number of stomachs, this arrangement can not be considered final.

TABLE I.—*Percentage of animal and vegetable food found in stomachs of flycatchers.*

Species.	Number of stomachs.	Animal food.	Vegetable food.
Olive-sided flycatcher (Nuttallornis borealis)	69	99.95	0.05
Western wood pewee (Myiochanes richardsoni)	174	99.93	.07
Say's phœbe (Sayornis sayus)	111	99.78	.22
Black phœbe (Sayornis nigricans)	344	99.41	.59
Western yellow-bellied flycatcher (Empidonax difficilis)	157	99.31	.69
Wood pewee (Myiochanes virens)	359	98.97	1.03
Least flycatcher (Empidonax minimus)	177	97.83	2.17
Acadian flycatcher (Empidonax virescens)	100	97.05	2.95
Yellow-bellied flycatcher (Empidonax flaviventris)	103	97.01	2.99
Scissor-tailed flycatcher (Muscivora forficata)	129	96.12	3.88
Alder flycatcher (Empidonax trailli alnorum)	135	96.05	3.95
Crested flycatcher (Myiarchus crinitus)	265	93.70	6.30
Ash-throated flycatcher (Myiarchus cinerascens)	91	92.32	7.68
Arkansas kingbird (Tyrannus verticalis)	109	90.61	9.39
Phœbe (Sayornis phœbe)	370	89.23	10.77
Kingbird (Tyrannus tyrannus)	665	88.93	11.07
Cassin's kingbird (Tyrannus vociferans)	40	78.57	21.43
Total or average	3,398	94.99	5.01

In the following table the species are arranged in their natural order, with the percentages of the principal elements of the food and the average of each kind in all the stomachs. It will be noted that Hymenoptera (wasps, bees, and ants) amount to nearly 35 per cent of the average diet of the 17 species, or more than one-third of their food. Of 13 of these species Hymenoptera are the largest element in the diet. Of 1 species Orthoptera (grasshoppers and crickets) are the leading food; in another Lepidoptera (moths and caterpillars) are the favorites, and in 2 others Diptera (flies) stand at the head. Hemiptera (bugs) are eaten quite extensively by some, but naturally the ones taken are the larger flying species. Plant lice and scales have not yet been found in the stomach of any flycatcher, though one bird was shot on a plant covered with lice, with which its bill was filled.

TABLE II.—*Detailed classification of food of flycatchers.*

Species.	Total animal food.	Total vegetable food.	Coleoptera (beetles).	Hymenoptera (wasps, bees, and ants).	Hemiptera (bugs).	Diptera (flies).	Orthoptera (grasshoppers and crickets).	Lepidoptera (moths and caterpillars).	Miscellaneous insects.	Arachnida (spiders and myriapods).	Fruit.	Miscellaneous vegetable food.
Scissor-tailed flycatcher	96.12	3.88	13.74	12.81	10.17	3.80	46.07	4.61	0.39	4.53	2.43	1.45
Kingbird	88.93	11.07	25.35	32.39	3.77	3.19	11.83	3.18	7.70	1.52	10.71	.36
Arkansas kingbird	90.61	9.39	17.02	31.38	5.36	.55	27.76	7.31	.99	.24	9.34	.05
Cassin's kingbird	78.57	21.43	14.91	21.61	3.41	2.91	14.67	18.21	2.51	.34	19 09	2.34
Crested flycatcher	93.70	6.30	16.78	13.69	14.26	3.06	15.62	21.38	4.88	4.03	5.36	.94
Ash-throated flycatcher	92.32	7.68	7.26	26.94	20.11	12.83	5.14	17.11	1.98	.95	7.64	.04
Phœbe	89.23	10.77	15.33	26.69	10.38	6.89	12.91	8.86	8.17	.00	4.99	5.78
Say's phœbe	99.78	.22	15.67	30.72	4.45	16.67	15.36	12.12	3.46	1.33	.06	.16
Black phœbe	99.41	.59	13.32	30.82	10.56	28.26	2.45	8.22	5.43	.35	.28	.31
Olive-sided flycatcher	99.95	.05	6.24	82.56	3.25	.88	1.12	4.13	1.77	.00	.04	.01
Wood pewee	98.97	1.03	14.23	28.20	5.99	29.98	3.44	12.31	2.61	2.21	.84	.19
Western wood pewee	99.93	.07	5.44	39.81	1.79	44.25	.00	5.17	3.23	.24	.05	.02
Yellow-bellied flycatcher	97.01	2.99	16.53	46.25	4.16	14.89	.00	5.68	.98	8.52	2.51	.48
Western yellow-bellied flycatcher	99.31	.69	8.39	38.76	8.44	31.22	.62	6.59	.71	4.58	.38	.31
Acadian flycatcher	97.05	2.95	13.76	39.93	6.03	8.15	6.38	18.87	.99	2.94	2.68	.27
Alder flycatcher	96.05	3.95	17.89	41.37	7.24	14.20	3.91	7.73	2.77	.94	3.88	.07
Least flycatcher	97.83	2.17	21.35	41.10	11.12	11.34	2.59	7.27	.95	2.11	1.83	.34
Average	94.99	5.01	14.31	34.41	7.68	13.71	9.99	9.93	2.91	2.05	4.24	.77

Farmers and horticulturists have never accused the flycatchers of doing any harm to their crops. The most that has been said against them is that certain of the larger species feed to a harmful extent upon honeybees. Stomach examinations, however, do not sustain this accusation. Honeybees do not form an important percentage of the food, and, moreover, a large proportion of those eaten are drones or males, of which, as is well known, there is in every hive a superfluity. The real harm, if any, done by this family of birds is in the destruction of predaceous and parasitic Hymenoptera. Of the former, however, so few are eaten that their loss is of no practical importance. Some parasitic Hymenoptera are taken by most flycatchers, and with certain of the smaller species they amount to a considerable percentage of the food. While theoretically this is harmful to the interests of husbandry, the precise amount of the damage is impossible of estimation. The parasites themselves often destroy useful insects, including other parasites, or are themselves destroyed by other insects, so that the question of the final result involves a problem so delicate and complicated as to preclude exact solution.

It is a well-known fact that Hymenoptera, aside from the parasitic species, are largely instrumental in the pollenization of plants, and many species are absolutely dependent upon insects for this service. So completely is this true that where cucumbers are raised under glass it is necessary to keep a hive of bees in each house or the crop will fail. In view of this fact the birds must be considered to render a very questionable service in destroying so many of these insects. On the other hand a single insect can pollinate a great many flowers, and as these insects are usually superabundant the harm done by their destruction is less than might at first be supposed. Moreover, this order of insect is not the only one that enjoys the distinction of serving as pollen bearers. Many beetles and flower-loving flies also transfer pollen from flower to flower and so help in this necessary work.

In considering the economic bearings of the food of the flycatchers one is impressed by the fact that it includes a large percentage of useful insects. The great order of Hymenoptera, which constitutes one-third of the average food of the flycatcher family, may fairly be classed as beneficial. The absolutely harmful species in this group are comparatively few, while the decidedly useful ones are many. As shown in the following pages, however, their food includes many insects other than Hymenoptera which are seriously destructive to crops, and it is believed that, weighing as impartially as possible the injuries done and the benefits conferred by them, their good qualities outweigh the bad and that the flycatchers herein discussed fairly earn the right to live unmolested.

SCISSOR-TAILED FLYCATCHER.

(*Muscivora forficata.*)

The scissor-tailed flycatcher is found in the United States, chiefly from central and eastern Texas and Oklahoma to southern Kansas, during the months from March to October; casually in western Louisiana, western Arkansas, and southwestern Missouri. In winter it moves farther south and with few exceptions retires beyond our southern boundary. Like the kingbird it prefers the open country to forests, and seems to be best suited with prairies or rolling country with scattered trees on which it can nest. In settled territory it takes kindly to orchards and even gardens in the near vicinity of buildings. While generally a quiet bird that lives on good terms with its neighbors, it displays something of the aggressive spirit of the kingbird in relation to crows and hawks, which it attacks with great vigor when they appear near its nest. The following description of some of the bird's habits is as good as has been written:

> One of his favorite performances is to fly up and, with rattling wings, execute an aerial seesaw, a line of sharp-angled VVVVVVV's, helping himself at the short turns by rapidly opening and shutting his long white scissors. As he goes up and down he utters all the while a penetrating scream *ka-quee'-ka-quee'-ka-quee'-ka-quee'-ka-quee'*, the emphasis being given each time at the top of the ascending line.
>
> Frequently when he is passing along with the even flight of a sober-minded crow, and you are quietly admiring the salmon lining of his wings, he shoots rattling into the air, and as you stare after him drops back as suddenly as he rose. He does this apparently because the spirit moves him, as a boy slings a stone at the sky, but fervor is added by the appearance of a rival or an enemy, for he is much like a *Tyrannus* in his masterful way of controlling his landscape. He will attack caracaras and white-necked ravens, lighting on their backs and giving them vicious blows while screaming in their ears.[1]

The following discussion of this bird's food is based upon the contents of 129 stomachs taken in the months from April to October, inclusive. They are rather irregularly distributed, and only one was taken in the latter month. They were collected in the State of Texas except one from Florida, which is considerably outside of the bird's usual range. The animal food amounts to 96.12 per cent of the stomach contents, practically all of which was made up of insects and spiders. The vegetable food amounts to 3.88 per cent and is composed of small fruits and seeds.

Animal food.—Of the animal food beetles amount to 13.74 per cent and form a rather constant article of diet. Less than 1 per cent belong to theoretically useful families. The others are practically all of harmful species. *Diabrotica 12-punctata* was found in 1 stomach. This is the well-known 12-spotted cucumber beetle, which often does great injury to that plant, as well as to squash vines, corn, clover, beets, beans, peas, and asparagus. Snout beetles, or weevils, were

[1] Bailey, Florence Merriam, Handbook of Birds of the Western United States, p. 247, 1902.

found in a number of stomachs and 4 contained the well-known cotton-boll weevil (*Anthonomus grandis*), an insect which for the last 10 years has threatened the whole cotton industry of the South. The month of greatest beetle consumption is May, while June shows the least, but as only 2 stomachs were taken in that month the record is perhaps not reliable. Hymenoptera (bees and wasps) are eaten to the extent of 12.81 per cent, which is the lowest record but one for this item among the flycatchers. As a rule, Hymenoptera constitute one of the most important elements of the flycatcher's diet. As these insects, except the ants, are almost constantly on the wing during daylight, they are peculiarly adapted to the flycatcher's method of feeding. Those eaten by the scissortail are mostly of the larger kinds, i. e., bees and wasps, with very few of the smaller parasitic species.

Hemiptera (bugs) amount to 10.17 per cent of the diet and were found in 47 stomachs. At least 9 families were identified, but Pentatomidæ (stinkbugs) were the most abundant and were found in 22 of the 47 stomachs. In 2 stomachs was identified that disagreeable pest the squash bug (*Anasa tristis*). This creature is not classified by entomologists in the stinkbug family, but as far as disgusting odor is concerned it is well qualified for that honor. As is well known, it is a great pest upon squash vines and other cucurbitaceous plants. Most of the other bugs identified are harmful. Diptera (flies) do not seem to appeal to this flycatcher as articles of food. They were found in the stomachs taken in April, May, and September only, and amount to but 3.80 per cent. Diptera occurred in only 14 stomachs, in 8 of which they were identified as robber flies (Asilidæ), an insect which will be more fully discussed in relation to the kingbird.

Orthoptera (grasshoppers and crickets) are evidently the favorite food of the scissortail. They were found in the stomachs of every month, with a good percentage in all except April. The average for the year is 46.07 per cent—the highest for any flycatcher. The 1 stomach taken in October contained 86 per cent of these insects, but it is probable that the month of maximum consumption is July, when they amount to over 65 per cent. As this bird is said to seldom light upon the ground, it follows that these insects must be captured when they take their short flight or jumps. *Melanoplus femur-rubrum* was identified in 1 stomach and was probably contained in many more but too badly broken for recognition. This is the well-known red-legged grasshopper that often does great harm to grass and grain crops. In general grasshoppers and crickets are eaten to the greatest extent by the ground-feeding birds, such as the meadowlark, while the flycatchers take the flying Hymenoptera. In this case the rule seems to be reversed. Of the 129 stomachs 88

contained grasshoppers or crickets and 8 held no other food. Caterpillars, with a few moths, constitute a small but rather regular article of diet with the scissortail. They amount to 4.61 per cent for the year and were found in the stomachs of every month except October. In several stomachs the cotton leaf worm (*Alabama argillacea*) was identified and the cotton bollworm (*Heliothis obsoleta*) in another. Both of these are well-known pests of the cotton plant and also feed upon a number of other cultivated plants. The latter is also well known as the corn worm, because it feeds upon the sweet corn of the garden. It also preys upon tomatoes and occasionally upon beans and peas. A few dragon flies and some other miscellaneous insects and spiders make the rest of the animal food, 4.92 per cent.

Following is a list of the insects identified in the stomachs and the number of stomachs in which each is contained:

HYMENOPTERA (bees and wasps).

Vespa sp	1	*Ophion* sp	1
Chrysis sp	1	*Pogonomyrmex* sp	4

COLEOPTERA (beetles).

Cicindela rectilatera	2	*Euphoria inda*	1
Cicindela schauppii	2	*Stenosphenus delosus*	1
Megilla maculata	1	*Cyllene crinicornis*	2
Coccinella abdominalis	1	*Cyllene robiniæ*	1
Hister abbreviatus	1	*Leptura* sp	1
Acmæodera militaris	1	*Oberea* sp	1
Ellychnia corrusca	1	*Cryptocephalus cribripennis*	1
Chauliognathus marginatus	2	*Diabrotica 12-punctata*	1
Canthon lecontei	4	*Macrobasis albida*	4
Canthon cyanellus	1	*Epicauta lemniscata*	2
Canthon lævis	1	*Epicauta funebris*	4
Canthon sp	2	*Epicauta* sp	1
Onthophagus pennsylvanicus	1	*Ophryastes tuberosus*	2
Onthophagus sp	1	*Phacepholis elegans*	1
Bolboceras farctus	1	*Anthonomus grandis*	4
Dichelonycha sp	1	*Balaninus* sp	2
Lachnosterna sp	1	*Calandra oryzæ*	1
Euphoria fulgida	1		

LEPIDOPTERA.

Cotton leaf worm (*Alabama argillacea*)	3	Cotton bollworm (*Heliothis obsoleta*)	1

HEMIPTERA (bugs).

Cicada sp	1	*Euschistus* sp	1
Aulacizes irrorata	1	*Thyanta custator*	2
Stiretrus anchorago	1	*Anasa tristis*	2
Œbalus pugnax	1	*Phymata* sp	1
Euschistus servus	1	*Zaitha* sp	1

ORTHOPTERA (grasshoppers, crickets, etc.).

Syrbula acuticornis	1	*Chortophaga viridifasciata*	1
Melanoplus femur-rubrum	1	*Tettigidea lateralis*	1
Melanoplus sp	1	*Gryllus* sp	9

NEUROPTERA

Mantispa brunnea	3	*Mantispa* sp	1

Vegetable food.—The vegetable food consists of small fruit, or berries, and a few seeds. The total percentage, 3.88, indicates that this is not the favorite kind of food, but is taken for variety.

Summary.—It needs but little study of the food of the scissor-tailed flycatcher to show that where the bird is abundant it is of much economic value. Its food consists almost entirely of insects, including so few useful species that they may be safely disregarded. Its consumption of grasshoppers is alone sufficient to entitle this bird to complete protection.

THE KINGBIRD.

(*Tyrannus tyrannus.*)

The kingbird (frontispiece), sometimes known as the bee martin, inhabits nearly the whole of the United States and extends north far into British America. It is much less abundant in the southwestern part of the country, having never been taken in Arizona and rarely in California. In winter it passes beyond the southern boundary of the United States. It is one of the largest of our flycatchers and probably the most common one east of the Rocky Mountains.

The favorite haunts of the kingbird are orchards and open pastures, and it will often nest in the near vicinity of farm buildings. Many cases are on record where chickens and other poultry have been saved from hawks by the timely interference of kingbirds that were nesting near by. This habit of the bird was noted by observers more than two centuries ago. Thus we find in Josselyn's Voyages to New England (published in 1675, p. 96) the following account:

"There is a small Ash-color Bird * * * that falleth upon Crows, mounting up into the air after them, and will beat them till they make them cry."

The kingbird seems to be by nature very pugnacious and noisy, and when it nests in orchards in the vicinity of robins, a constant warfare is kept up between the two species. While the plumage of this bird is not conspicuously colored, it has upon its head a concealed crown patch of brilliant orange or scarlet which can be brought into view by the erection of the coronal feathers.

In the investigation of the food of the kingbird 665 stomachs were examined. They were taken in the months from March to October,

inclusive, though only 3 were collected in March and 1 in October. The other months were well represented. Geographically they are distributed through 29 States, the District of Columbia, and British America. The food is composed of 88.93 per cent of animal matter to 11.07 of vegetable. The former is made up of insects and a few spiders, the latter is mostly small fruit.

Animal food.—Useful beetles, mostly the predaceous ground beetles (Carabidæ), amount to 4.64 per cent for the whole period. The 1 stomach taken in October contained 12 per cent, but in July, when 157 stomachs were examined, the average was less than 7 per cent. The rose chafer, more commonly known as the rose bug (*Macrodactylus subspinosa*), is not much eaten by birds. It comes, usually in swarms, about the month of June when the roses bloom. It is very destructive to roses and some other flowers. The kingbird seems to have a special liking for this insect, as it was found in 24 stomachs and 1 contained 40 individuals. Other beetles identified, that are of special economic importance, are the asparagus beetle (*Crioceris asparagi*), the spotted cucumber beetle (*Diabrotica 12-punctata*), and the locust leaf miner (*Odontota dorsalis*). The last sometimes completely defoliates locust trees. One stomach held over 100 specimens of a small dung beetle (*Aphodius inquinatus*), which sometimes flies in swarms in the late afternoon, when it is probably taken by the kingbird. A few stomachs were collected in the cotton fields of Texas, and 4 of them contained remains of the notorious cotton-boll weevil (*Anthonomus grandis*). Several other stomachs contained the clover-leaf weevil (*Phytonomus punctatus*) and the imbricated snout beetle (*Epicærus imbricatus*). All of these are pests, and the latter seems to feed upon nearly every variety of fruit and vegetable. *Sphenophorus zeæ*, the corn weevil, which feeds upon the roots and stalks of corn, was identified in 1 stomach.

Perhaps the most surprising and unexpected components of this bird's food are the blister beetles (Meloidæ). They appear in the food to some extent in every month in which stomachs were collected (except the 1 stomach in October); and in September, when 46 stomachs were taken, they amount to 11.55 per cent of the whole food for that month. For the entire eight months they aggregate 2.69 per cent, which is not a large percentage, but the wonder is that they are eaten at all. As is well known, these insects contain the drug commonly known as cantharadin, which beside its property of blistering the skin produces other peculiar physiological effects when taken internally. It seems hardly credible that a bird could eat without harm an insect that causes a blister when crushed upon the human skin, but that this bird does eat them, and apparently as many of them as it can get, is shown by the fact that 8 of these beetles were found in 1 stomach, 10 in another, 11 in each of 2 others, 13 in each of 4, and 14 in another. They were found in 70 stomachs, or over 11 per cent of the whole, and

in 1 stomach they constituted 97 per cent of the contents and in several others the percentage was nearly as great. The species identified from the stomachs are *Epicauta trichrus, E. cinerea, E. pennsylvanica, Macrobasis unicolor, Nemognatha cribricollis,* and *Meloe americanus.* Other beetles, all of which belong to more or less harmful families, amount to 18.02 per cent. If to these we add the Carabidæ and Meloidæ, we have an aggregate of 25.35 per cent of beetles in the diet, the largest item but one.

Hymenoptera amount to 32.39 per cent of the food, the largest item. Of these probably about one-fourth are parasitic species that must be reckoned as useful insects. Of the others the one which has attracted most attention in connection with the kingbird is the common honeybee (*Apis mellifera*). The bird has for years had the reputation of catching honeybees to an injurious extent; indeed, some bee keepers declare that if left to prey upon the bees unmolested it will destroy the whole colony. The testimony upon this point, however, is very contradictory, and other observers equally reliable say that the bird takes few, if any, bees, and still others declare that it takes only the useless drones.

The following are samples of testimony upon this point:

Mr. I. N. Arnold, writing from Richmond, Ohio, under date of September 5, 1885, says:

> The bee martin, or kingbird, is very destructive to bees. * * * I have seen the kingbird bring its young as soon as they could fly and stay close to the apiary and feed exclusively on bees. They are most destructive to bees that are coming in laden, and they are liable to catch a valuable queen when she is out to mate. I am running a large apiary, and have been annoyed a great deal by the bee birds.

Mr. P. R. Staunton, of Le Roy, N. Y., says:

> The kingbird feeds upon bees. It is especially dangerous when bees are swarming, as there is danger then of losing the queen. Every apiarist keeps a gun in his yard ready to entertain the kingbird. The bird will hover in the air and snap up bees as rapidly as they come within reach. * * * Every snap of the bill means a bee lost.

The following from Mr. J. P. H. Brown, of Augusta, Ga., under date of September, 1886, gives a different view of the subject:

> In regard to birds feeding on the honeybee, I can speak positively on the subject. I keep from 150 to 200 colonies of Italian bees, and make the breeding of queen bees a specialty. For the last 15 years I have made the habits of the birds infesting my apiary a study. They are mocking birds, bee martins, redbirds, and catbirds. They build their nests in the shrubbery and trees in my apiary. Bee keepers generally give these birds a bad reputation and exterminate them. I have watched the bee martin, the worst reputed bird of the lot, at times when I thought I saw him take a bee, shot him, and quickly opened his crop. Thus far I have failed to find anything in it like a worker bee. I have often detected the remains of drone bees and other insects; hence I have ceased to destroy the birds and allow them to have full liberty. The drone or male bees have no sting, and birds, as well as very young chickens, can soon learn to distinguish a drone from a worker.

Of 665 stomachs examined, honeybees were found in 22. The total number in these 22 stomachs was 61, of which 51 were drones,

8 were workers, and 2 indeterminate. When we consider that in the stomachs examined there must have been at least 10,000 insects, and probably three times that number would be nearer the mark, it will at once be seen that the proportion of honeybees in the kingbird's diet is small.

Other Hymenoptera in the kingbird's food are ordinary bumblebees, wasps, and hornets of various species, of which probably the best that can be said is that they perform a useful function in the fertilization of flowers. As there is little danger that there will ever be too few of them for this service, the birds are doing no great harm in feeding upon the surplus.

Hemiptera (bugs) are not an important element of the kingbird's food, though they were found in the stomachs of every month except March. In April they amount to 7.25 per cent, which is the highest of any month. The average for the year is 3.77 per cent. As might be expected, the species are such as can be taken on the wing and do not include such sedentary creatures as scales and plant lice. Stinkbugs (Pentatomidæ) and cicadas, with a few assassin bugs (Reduviidæ), make up the bulk of this item.

Diptera (flies) are eaten by the kingbird in only moderate quantities, though they appear in the stomachs of every month except the one taken in October. The maximum percentage, 8.36, occurs in May, and the average for the year is 3.19 per cent. They belong to several families, but one is of especial interest in relation to the kingbird and honeybees. This is the family of the robber flies (Asilidæ), most of which are large, long-bodied, hairy creatures that fly with a loud, buzzing sound and are usually seen about flowers in bright sunshine, preying upon the insects that come to the flowers for honey. They might be thought to be useful insects were it not for the fact that some species have a special liking for honeybees, which they kill in considerable numbers. The late Dr. Riley states that one species (*Promachus fitchii*) has been known to kill 141 honeybees in a single day. Mr. T. J. Parrish, writing from Gainesville, Tex., in 1886, refers to robber flies as follows:

> The kingbird does not feed upon bees, but an insect about three times as large as the bee, which carries off honey-laden bees, kills them, and appropriates the honey. It is a hump-backed, long-tailed, spider-legged monstrosity, of rapid flight, and appears in July and August.

Prof. A. J. Cook, a well-known authority on bees, in an article on the natural enemies of the honeybee, speaks of these flies as follows:

> Among Diptera the family Asilidæ (robber flies) afford the most serious pests to the apiarist * * *. There are at least 3 species of *Asilus*, 2 of *Mallophora*, 2 of *Promachus*, 2 of *Laphria*, and 2 of *Erax* that catch and kill bees. These predaceous flies work the most serious mischief south, but are not exempt from blame even as far north as Ontario.[1]

[1] American Naturalist, XV, p. 200, 1881.

Robber flies were found in 19 of the stomachs, and 1 contained 6 individuals. In all, 26 were identified, which would seem to be abundant payment for the 8 worker bees. A few syrphus and tachinid flies and a number of the long-legged crane flies (Tipulidæ) make up the rest of the Diptera of the kingbird's diet.

Lepidoptera (moths, butterflies, and their larvæ) form 3.18 per cent of the food of the kingbird. Most birds eat adult Lepidoptera (moths and butterflies) but sparingly, preferring their larvæ, commonly known as caterpillars. The flycatchers, however, eat quite a number of moths as well as caterpillars. They were found in the stomachs of the kingbird in nearly every month except March and October, when but few stomachs were taken. Beginning with a maximum of 5.60 per cent in April, they decrease quite regularly to a minimum of 2.87 per cent in July, after which they again increase to 4.61 per cent in September. The cotton worm (*Alabama argillacea*) is the only insect of this order found in the stomachs which is of any special interest. This was found in a few stomachs of birds taken in the cotton fields of Texas and was in the larval or caterpillar state. Other Noctuidæ (cutworms) either as adults or larvæ were identified in seven stomachs.

Orthoptera (grasshoppers, crickets, etc.) stand third in importance in the kingbird's food and during July and August exceed any other element. None were found in the stomachs taken in March and October, but in April they amounted to 2.40 per cent, from which they gradually increased to 32.83 in August, and then rapidly decreased and disappeared. The average for the year was 11.83 per cent. Like many other eastern birds, the kingbird takes advantage of the abundance of grasshoppers in July and August and replaces some other articles of diet with them. Besides the insects already enumerated, the kingbird eats some dragon flies and ephemerids, with an occasional raphidian, and now and then a scorpion fly (*Panorpa*), in all making 1.52 per cent of the diet. The bones of a tree frog, those of a lizard, a few crustaceans (*Oniscus*), commonly known as sow bugs, and the shell and lingual ribbon of a snail were also found. These last were evidently not regular articles of diet and amounted to only 1.29 per cent.

Following is a list of the animal food identified in the stomachs and the number of stomachs in which each species occurred:

HYMENOPTERA (wasps, bees, etc.).

Apis mellifera	22	*Megachile* sp	1
Bombus vagans	1	*Cœlioxys 8-dentata*	1
Bombus sp	1	*Andrena* sp	2
Melissodes sp	5	*Agapostemon* sp	3
Epeolus sp	1	*Halictus* sp	3
Xylocopa sp	1	*Colletes* sp	1
Megachile brevis	1	*Crabro* sp	2

Bembex fasciata	1	*Camponotus esuriens*	1
Ammophila gryphus	1	*Camponotus* sp	2
Ammophila varipes	2	*Lasius alienus*	1
Ammophila sp	2	*Lasius* sp	2
Pompilus sp	2	*Formica fusca*	11
Vespa germanica	1	*Formica integra*	1
Vespa maculata	2	*Formica schaufussi*	1
Polistes sp	1	*Formica* sp	2
Odynerus sp	3	*Ichneumon lætus*	1
Chrysis sp	1	*Ichneumon* sp	2
Myzine 6-cincta	2	*Cryptus americanus*	1
Myzine sp	2	*Cryptus* sp	2
Tiphia inornata	3	*Lampronota* sp	1
Tiphia tarda	1	*Pimpla* sp	1
Tiphia sp	2	*Xylonomus* sp	1
Cremastogaster pennsylvanica	5	*Ophion bilineatum*	1
Solenopsis debilis	1	*Ophion* sp	4
Myrmica sp	1	*Limneria* sp	1
Aphænogaster fulva	1	*Paniscus geminatus*	1
Aphænogaster tennesseense	1	*Tremex columba*	1
Aphænogaster sp	1	*Tremex* sp	1

COLEOPTERA (beetles).

Cicindela purpurea	3	*Staphylinus cinnamopterus*	2
Cincindela vulgaris	2	*Staphylinus* sp	1
Cicindela 12-guttata	1	*Philonthus* sp	3
Cicindela punctulata	2	*Coccinella 9-notata*	2
Cicindela sp	7	*Coccinella sanguinea* var. *munda*	1
Calosoma calidum	2	*Anatis ocellata*	1
Elaphrus sp	1	*Hister cœnosus*	2
Clivina sp	1	*Hister abbreviatus*	2
Pterostichus sayi	1	*Hister americanus*	1
Pterostichus sp	1	*Saprinus assimilis*	1
Amara exarata	2	*Trogosita virescens*	1
Amara impuncticollis	2	*Melanotus* sp	3
Amara bipunctata	1	*Limonius auripilis*	1
Amara sp	3	*Limonius* sp	3
Calathus gregarius	2	*Athous* sp	1
Platynus sp	2	*Corymbites hieroglyphicus*	1
Lebia grandis	2	*Dicerca obscura*	1
Chlænius sp	1	*Dicerca* sp	1
Geopinus incrassatus	1	*Agrilus* sp	1
Cratacanthus dubius	3	*Phengodes fusiceps*	1
Agonoderus lineola	1	*Chauliognathus pennsylvanicus*	12
Agonoderus pallipes	2	*Chauliognathus marginatus*	11
Harpalus pennsylvanicus	1	*Chauliognathus* sp	6
Harpalus sp	5	*Podabrus diadema*	3
Anisodactylus rusticus	2	*Telephorus carolinus*	1
Anisodactylus discoideus	2	*Telephorus rotundicollis*	2
Anisodactylus baltimorensis	2	*Telephorus bilineatus*	2
Anisodactylus sp	5	*Amphicerus punctipennis*	1
Sphæridium scarabæoides	2	*Canthon praticola*	1
Necrophorus guttata	1	*Canthon lævis*	1

Canthon sp	1	*Typocerus zebratus*	1
Copris sp	1	*Leptura cordifera*	1
Onthophagus nuchicornis	1	*Leptura* sp	1
Onthophagus hecate	5	*Monohammus scutellatus*	1
Onthophagus sp	14	*Dectes spinosus*	1
Atænius cognatus	2	*Oberea* sp	2
Atænius sp	2	*Crioceris asparagi*	1
Aphodius fossor	3	*Cryptocephalus venustus*	1
Aphodius fimetarius	57	*Cryptocephalus leucomelas*	1
Aphodius ruricola	1	*Typophorus viridicyanea*	3
Aphodius granarius	1	*Chrysomela pulchra*	1
Aphodius inquinatus	7	*Chrysomela elegans*	1
Aphodius rubeolus	1	*Gastroidea* sp	1
Aphodius sp	6	*Lina trilineata*	1
Bolboceras farctus	11	*Diabrotica 12-punctata*	3
Dichelonycha elongata	1	*Disonycha* sp	1
Dichelonycha subvittata	1	*Odontota dorsalis*	2
Dichelonycha sp	10	*Chelymorpha argus*	5
Macrodactylus subspinosus	31	*Chelymorpha cribraria*	2
Lachnosterna congrua	3	*Epitragus acutus*	1
Lachnosterna fusca	1	*Scotobates calcaratus*	2
Lachnosterna sp	5	*Tenebrio molitor*	1
Anomala binotata	3	*Opatrinus aciculatus*	1
Anomala varians	4	*Meloe americanus*	1
Anomala lucicola	1	*Meloe* sp	1
Anomala marginata	1	*Nemognatha cribricollis*	1
Anomala sp	8	*Macrobasis unicolor*	4
Strigoderma pygmæa	1	*Epicauta trichrus*	1
Aphonus tridentatus	1	*Epicauta cinerea*	2
Allorhina nitida	1	*Epicauta funebris*	5
Euphoria sepulchralis	1	*Epicauta pennsylvanica*	2
Euphoria melancholica	2	*Epicauta* sp	3
Euphoria fulgida	1	*Epicærus imbricatus*	3
Euphoria inda	4	*Phytonomus punctatus*	13
Euphoria sp	1	*Anthonomus grandis*	5
Cremastochilus knochii	2	*Balaninus* sp	1
Cremastochilus castaneæ	3	*Rhodobænus 13-punctatus*	1
Cremastochilus sp	7	*Sphenophorus costipennis*	1
Anthophilax malachiticus	1	*Sphenophorus melanocephalus*	1
Strangalia luteicornis	1	*Sphenophorus zeæ*	4

DIPTERA (flies).

Tabanus tener	1	*Promachus* sp	1
Tabanus sp	1	*Proctacanthus milberti*	1
Deromyia sp	1		

LEPIDOPTERA (butterflies and moths).

Agrotis sp	1	*Alabama argillacea*	2

MECOPTERA.

Panorpa sp (scorpion fly)	2

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ODONATA (dragon flies).

Agrion sp.	3	*Diplax intacta*	2

NEUROPTERA.

Mantispa sp.	1

HEMIPTERA (bugs).

Tibicen cruentifera	1	*Hymenarcys nervosa*	1
Tibicen sp.	1	*Lygæus turcicus*	1
Podisus spinosus	1	*Phymata fasciata*	1
Euschistus variolarius	1	*Sinea diadema*	7
Euschistus fissilis	1	*Gerris marginatus*	1
Euschistus sp.	7	*Hydrometra* sp.	1

ORTHOPTERA (grasshoppers, crickets, etc.).

Melanoplus femur-rubrum	19	*Tettix* sp.	2
Melanoplus sp.	24	*Udeopsylla robusta*	1
Chortophaga viridifasciata	4	*Nemobius vittatus*	1
Camnula pellucida	1	*Gryllus* sp.	2
Dissosteira carolina	2	*Œcanthus* sp.	1

CHILOGNATHA.

Julus sp. (milleped)	2

ARACHNIDA (spiders).

Attus sp.	1	*Lycosa* sp.	1

Vegetable food.—The vegetable food of the kingbird amounts to 11.07 per cent of its diet, and consists of small fruit, with an occasional seed. Altogether it was found in 302 stomachs. None was contained in the three stomachs taken in March nor in the one taken in October, but beginning with less than 2 per cent in April there is a steady increase to 35.50 per cent in September. Of uncultivated small fruits 25 species were identified, not counting the rubus fruits (raspberries and blackberries), which may have been either cultivated or wild. These last were found in 74 stomachs, which is more than in any other species. Cultivated cherries were identified in 11 stomachs; strawberries, which may have been wild, in 2; figs in 1; and currants in 1. Grapes were contained in several stomachs, but were apparently all of wild species. A few seeds were found and some bits of rubbish, but these were probably swallowed accidentally with an insect or other food.

Following is a list of fruit and seeds identified in the stomachs:

Dandelion (*Taraxacum officinale*)	1	Alternate-leaved dogwood (*Cornus alternifolia*)	1
Common elder (*Sambucus canadensis*)	5	Panicled dogwood (*Cornus paniculata*)	1
Elder (*Sambucus* sp.)	6	Rough-leaved dogwood (*Cornus asperifolia*)	20
Common nightshade (*Solanum nigrum*)	1	Kinnikinnik (*Cornus amomum*)	2
Blueberry (*Vaccinium* sp.)	19		
Huckleberry (*Gaylussacia* sp.)	4		

Dogwood (*Cornus* sp.)	5	June berry (*Amelanchier canadensis*)	5
Fox grape (*Vitis vulpina*)	1	Chokeberry (*Pyrus arbutifolia*)	1
Frost grape (*Vitis cordifolia*)	6	Currant (*Ribes* sp.)	1
Northern fox grape (*Vitis labrusca*)	1	Spicebush (*Benzoin æstivale*)	8
Virginia creeper (*Psedera quinquefolia*)	5	Sassafras (*Sassafras variifolium*)	18
Bluewood (*Condalia obovata*)	1	Pokeberry (*Phytolacca decandra*)	10
Buckthorn (*Rhamnus lanceolatus*)	4	Amaranth (*Amaranthus* sp.)	1
Sumac (*Rhus* sp.)	1	Fig (*Ficus* sp.)	1
Domestic cherry (*Prunus* sp.)	11	Mulberry (*Morus* sp.)	14
Bird cherry (*Prunus pennsylvanica*)	4	Bayberry (*Myrica carolinensis*)	3
Chokecherry (*Prunus virginiana*)	10	Foxtail grass (*Setaria* sp.)	1
Wild black cherry (*Prunus serotina*)	8	Red cedar (*Juniperus virginianus*)	2
Blackberry and raspberry (*Rubus* sp.)	74	Sedge (*Rhynchospora* sp.)	1
Strawberry (*Fragaria vesca*)	2	Grass seed not further identified	2
		Fruit pulp not further identified	42
		Seeds not further identified	7

Summary.—From the above discussion of the vegetable food of the kingbird it is evident that the bird's economic status is to be determined entirely by its animal food, as the vegetable portion is practically neutral. Of the animal part the largest item, Hymenoptera, is composed largely of insects indirectly beneficial to the interests of man. A portion of them are parasitic upon caterpillars and other injurious species and probably are largely instrumental in holding these in check. On the other hand, they parasitize useful insects, and even the parasites themselves are destroyed by other parasite (hyperparasites). Other members of the order, such as wasps and bees, perform a useful function in pollenizing flowers. For these reasons the destruction of Hymenoptera in general can not be considered altogether desirable.

In the destruction of other kinds of insects the kingbird is conferring an almost unmixed blessing. A few of the beetles are theoretically useful, but bugs, grasshoppers, flies, and caterpillars embrace some of the worst pests to agriculture, and these, with the harmful beetles and a few miscellaneous insects, constitute 50 per cent of the kingbird's food. The internal relations of the other 50 per cent of the food are such as to render it neutral as a whole, thus leaving a balance of 50 per cent to the kingbird's credit.

ARKANSAS KINGBIRD.

(*Tyrannus verticalis.*)

The Arkansas kingbird (Pl. II) occupies during the breeding season the western portion of the United States from the Pacific Ocean eastward as far as Minnesota, Kansas, and Texas, though stragglers have been taken east of this line. It extends northward into British America, where it breeds, but in winter it retires entirely beyond the southern boundary of the United States. It is a bird

of the open country and avoids forests. A hilly country with here and there trees for nesting sites seems to be the ideal habitat. It takes kindly to civilization and the vicinity of gardens and buildings. Not rarely it nests in trees on the village streets and in some cases actually places its nest upon the structures of man; but in general it is less domestic than its eastern relative, whose nest is so often built in an orchard. It does not seem to have that antipathy to hawks and other birds so characteristic of the eastern kingbird, and a case is on record where it has built its nest on the same tree with a hawk and a Bullock's oriole.[1]

For the investigation of the food of the Arkansas kingbird 109 stomachs were available. They were collected in the months of March to October, inclusive, with 3 taken in December. The greater number of them are from California, but a few were collected in 6 other States. The food is found to consist of 90.61 per cent of animal matter to 9.39 per cent of vegetable. Of the animal portion, Hymenoptera (bees and wasps), Coleoptera (beetles), and Orthoptera (grasshoppers) constitute over three-fourths.

Animal food.—Beetles of all kinds amount to 17.02 per cent of the food, and include 5.47 per cent of useful species, mostly Carabidæ and Cicindelidæ. For a flycatcher this is a large record of these useful beetles, as they are largely ground-inhabiting species and not so often on the wing as most others. The remainder, 11.55 per cent, are either harmful or neutral. No special pests were found among them. Hymenoptera (bees and wasps) are the largest item of animal food and amount to 31.38 per cent. They form a good percentage of the food in every month except August, when they are partly replaced by grasshoppers. A few of the parasitic species were found, but not many. Honeybees (*Apis mellifera*) were noted in 5 stomachs. In all, there were 31 bees, of which 29 were males, or drones, and 2 were workers. This bird has been accused in California of eating honeybees to an injurious extent. It was said that the bird lingered near the hive and snapped up the honey-ladened bees as they returned from the field. This statement is not borne out by the facts stated above.

Hemiptera (bugs) are a small but rather regular constituent of the food of the Arkansas kingbird and were found in the stomachs of every month except October. March appears to be the month of maximum consumption, 19 per cent, but this can not be taken as proved, for only 3 stomachs were taken in that month. June, with 9.86 per cent from 28 stomachs, is more likely to be the month of true maximum. They belong to the stinkbug family, the leaf bugs (Capsidæ), and the shield-backs (Scutelleridæ), with a few cicadas. Altogether bugs amount to 5.36 per cent of the food.

[1] Bendire, C. E., Life Histories of North American Birds, I, p. 246, 1892.

ARKANSAS KINGBIRD.

Diptera (flies) constitute 0.55 per cent of the diet. In June 3.21 per cent were taken, but in no other month do they reach 1 per cent, and in March, September, October, and December none at all were eaten. This bird is apparently not much of a "flycatcher." Lepidoptera (moths and butterflies), including both adult moths and caterpillars, amount to 7.31 per cent of the food. When eaten at all they appear to constitute a fair percentage of the daily diet, but they are entirely absent from the stomachs of March, September, and October. A greater number of stomachs, however, might give a somewhat different result.

Orthoptera (grasshoppers, crickets, etc.) stand next to Hymenoptera in the diet of the Arkansas kingbird. March appears to be the month of least consumption, as the 3 stomachs taken then showed only 3.33 per cent while the 3 taken in December contained 44 per cent. In all the other months they constitute a good percentage of the food, and, as seems natural, August is the month of maximum consumption, with 61.58 per cent. The total for the year is 27.76 per cent. It is a singular fact that several western species of flycatchers eat more grasshoppers than do the meadowlark and blackbirds, which obtain their food almost wholly upon the ground. The reverse is the case with the corresponding eastern birds. The orthopterous food consists almost entirely of grasshoppers with very few crickets.

Dragon flies and a few other miscellaneous insects, millepeds and spiders, the bones of tree frogs in 3 stomachs, and egg shells, apparently those of a domestic fowl, make up the remainder of the animal food, 1.23 per cent.

Following is a list of the insects identified and the number of stomachs in which each was found:

HYMENOPTERA (bees and wasps).

Apis mellifera	5	*Prosopis affinis*	1
Melissodes sp	1	*Cryptus* sp	1
Habropoda sp	1	*Ophion bilineatus*	1
Andrena sp	1	*Ophion* sp	1

COLEOPTERA (beetles).

Platynus sp	1	*Onthophagus* sp	2
Anisodactylus baltimorensis	1	*Aphodius fimetarius*	2
Anisodactylus semipunctatus	1	*Aphodius* sp	2
Agabus sp	1	*Bolboceras farctus*	1
Hydaticus stagnalis	1	*Geotrupes* sp	1
Silpha ramosa	1	*Amphicoma ursina*	5
Staphylinus nigrellus	1	*Euphoria inda*	1
Staphylinus luteipes	1	*Euphoria* sp	1
Hister americanus	1	*Cremastochilus* sp	3
Megapenthes turbulentus	1	*Leptura instabilis*	1
Canthon lævis	1	*Epicauta* sp	1
Onthophagus hecate	1	*Balaninus* sp	1

DIPTERA (flies).

Bombylius sp.	1

HEMIPTERA (bugs).

Eurygaster alternatus	1	*Nezara* sp.	2
Podisus modestus	1	*Calocoris rapidus*	1
Euschistus servus	1		

Vegetable food.—Although vegetable food amounts to 9.39 per cent, it presents but little variety. A few weed seeds occurred in one stomach. Seeds and skins of elderberries (Sambucus) were found in 11 stomachs, woodbine (Psedera) in 2, hawthorn berries (Cratægus) in 1, an olive in 1, and skin and pulp of fruit not further identified in 2.

The following fruits were found in the stomachs:

Virginia creeper (*Psedera quinquefolia*)	2	Elderberry (*Sambucus* sp.)	11
Hawthorn (*Cratægus* sp.)	1	Olive (*Olea europæa*)	1

Summary.—The vegetable food of the Arkansas kingbird is of so little economic importance that it may be dismissed without further comment. The animal food is open to adverse criticism in only one point—the useful beetles. But even if it be admitted that the destruction of these is harmful to man's interests, the amount of damage is so small as to be completely overbalanced by the good done in other directions. The charge that the bird destroys honeybees is not sustained by the results of this investigation. On the whole, it appears that the Arkansas kingbird is one of the most useful birds in the region where it is found.

CASSIN'S KINGBIRD.

(*Tyrannus vociferans.*)

Cassin's kingbird occupies in the breeding season the western portion of the United States from the eastern slope of the Rocky Mountains westward to the Pacific and north to central California and southern Wyoming. It is rather irregularly distributed in this region and is entirely wanting over considerable areas. Like the two preceding species it prefers open, parklike country to forests, but it is said to be more of a mountain bird and to breed at higher altitudes. The habits of the bird must differ somewhat in different localities or at different seasons. Maj. Bendire says of it: "Cassin's kingbird is neither as noisy nor as quarrelsome as the preceding species" [*T. verticalis*].[1]

[1] Life Histories of North American Birds, I, p. 250, 1895.

Speaking of the same species, Dr. Edgar A. Mearns says:

> On the Mogollon Mountains I saw them attack crows and western red-tailed hawks and drive them from the neighborhood of their nests after the spirited fashion of the eastern kingbird.[1]

Only 40 stomachs of Cassin's kingbird were available for the study of its food. They are distributed very irregularly over the year, and none were taken in April, May, July, and August. While this scanty supply of material may give us some information as to what the bird eats, it can not furnish reliable data as to relative proportions. The food was found to be composed of 78.57 per cent of animal matter to 21.43 of vegetable.

Animal food.—Beetles of all kinds amount to 14.91 per cent of the food. Of these, about 1 per cent are of species that are more or less useful (Carabidæ). The others are Scarabæidæ, Cerambycidæ (*Saperda* sp.), Elateridæ, and Histeridæ (*Hister sellatus*). Hymenoptera amount to 21.61 per cent and consist for the most part of wild bees and wasps. No honeybees were found, but several predaceous or parasitic species were identified, such as *Tiphia inornata* and *Myzine 6-cincta*. As with many other flycatchers, Hymenoptera are the largest item of food. Hemiptera (bugs) are eaten rather irregularly and not in large quantities. They amount to 3.41 per cent. The only ones identified were of the family Pentatomidæ (stinkbugs). Diptera constitute only 2.91 per cent of the diet, which again illustrates the fact that some flycatchers do not catch many flies. They belong to the long-legged crane-fly family (Tipulidæ) and the family of the house fly (Muscidæ).

Lepidoptera, i. e., moths and caterpillars, amount to 18.21 per cent of the food, which is a high percentage for a flycatcher; for while moths may be caught on the wing, caterpillars must be picked from the surface on which they crawl, unless they let themselves down from a tree by a thread and so hang in mid-air. Caterpillars were found in 11 stomachs and moths in 6. Of the latter, 21 individuals were made out in 1 stomach. They are probably a very popular article of diet with this bird, as they appear in the food of every month, but in rather irregular amounts. More stomachs would probably give a more regular record. Orthoptera (grasshoppers and crickets) are apparently eaten rather irregularly, but as nearly every month in which they appeared at all showed a goodly quantity, they would seem to be a favorite food, and it is probable that a greater number of stomachs would give a more regular showing. In January they amount to 47.50 per cent in 4 stomachs, while the 1 stomach taken in February shows none at all. It is not probable, however, that January is really the month of maximum consumption of grasshoppers.

[1] The Auk, VII, p. 255, 1890.

The total for the year is 14.67. Had any stomachs been collected in August, the grasshopper month, there is little doubt that this record would have been considerably raised. A few dragon flies and some spiders make up the balance of the animal food, 2.85 per cent.

Vegetable food.—Although Cassin's kingbird eats more vegetable food than any other flycatcher, there is very little variety to it. Grapes, apparently of cultivated varieties, were found in 9 stomachs, olives in 2, elderberries in 1, blueberries (*Vaccinium*) in 1, and pulp not further identified in 4. With the exception of some grapes found in 1 of the March stomachs, all the fruit was eaten in the months from September to January, inclusive.

Summary.—In the choice of its animal food Cassin's kingbird does but little harm, as it eats only a few predaceous or parasitic insects, nor, so far as this investigation shows, does it attack honeybees. In selecting its vegetable food it shows considerable fondness for cultivated fruits, but no bird so thoroughly insectivorous as this flycatcher will ever become a menace to fruit culture.

CRESTED FLYCATCHER.

(*Myiarchus crinitus.*)

The crested flycatcher (Pl. III) occupies practically all that portion of the United States east of the Rocky Mountains and extends northward into southern Canada. It is somewhat more of a bird of the forest than the kingbirds, but, like them, frequents the open country and delights in orchards, especially if they be old with many hollow trees to serve as nesting sites. While extending over a vast area of country it is very irregularly distributed, being abundant in some portions and rare or wholly wanting in others. In winter it leaves the United States almost wholly, a few individuals only remaining in southern Florida and Texas.

For the investigation of the food of this bird 265 stomachs were available, which were obtained during the 6 months from April to September, inclusive. They were collected in 20 States, the District of Columbia, and Canada. In the first analysis the food divides into 93.70 per cent of animal matter to 6.30 per cent of vegetable.

Animal food.—Beetles constitute 16.78 per cent of the food, and of these 0.24 per cent are useful species. The remainder are mostly of an injurious character, some of them very harmful. The notorious cotton-boll weevil (*Anthonomus grandis*) was found in 2 stomachs taken in Texas, the strawberry weevil (*A. signatus*) in 1, and the plum curculio (*Conotrachelus nenuphar*) in 2. Besides these pests were the locust leaf miner (*Odontota dorsalis*) and species of *Balaninus*, which have been discussed in previous pages. While the record does not indicate any special preference for the harmful beetles, it does show that they are eaten as often as the average of the different

CRESTED FLYCATCHER

species. The month of maximum consumption of beetles is June with 25.81 per cent. After this they gradually decrease, but maintain a fair percentage through the season. Representatives of 12 different families were identified.

Hymenoptera amount to 13.69 per cent; more than 3 per cent less than the beetle food. Only one other flycatcher under investigation, the scissortail, eats more beetles than wasps and bees. Some of the useful parasitic species are included in this item, but the proportion is not large. Sawflies in the larval form were found in 6 stomachs and were the entire contents of 1. These are destructive insects. One worker honeybee was found, which was the only indication that the bird ever preys upon the occupants of the hive. May appears to be the month of maximum consumption of Hymenoptera, but every month shows a good percentage. Diptera (flies) amount to only 3.06 per cent, and while they are eaten to some extent in every month the amount is small, and the maximum, which occurs in July, is only 6.32 per cent—another illustration of the fact that flycatchers catch more of other insects than of flies. No species of special interest were noted, except one robber fly (Asilidæ), which can be taken as an offset to the honeybee. Horseflies (Tabanidæ) were noted in 14 stomachs, which would seem to indicate that they are the favorites among Diptera. Hemiptera (bugs) constitute 14.26 per cent of the diet. They belong to the usual families of stinkbugs, tree hoppers, leaf hoppers, and cicadas, with a few assassin bugs. The cicadas were more than usually abundant, being found in 8 stomachs, and in 1 they were the entire food. Stinkbugs (Pentatomidæ) were found in 44 stomachs, and 1 was entirely filled with them. These highly flavored insects are often eaten by birds, but usually only a small quantity is found in each stomach. Orthoptera, i. e., grasshoppers, crickets, and katydids, seem to be one of the favorite foods of the crested flycatcher. They were found in 45 stomachs and constituted the only food in 3. Beginning with 8.64 per cent in April the consumption steadily increases to September, when it is 23.18 per cent, though August is but a trifle less. The average of all the months is 15.62 per cent. Only 2 flycatchers have a greater record of grasshoppers than this.

Lepidoptera (moths and their larvæ) are the largest item of the food. Caterpillars were found in 73 stomachs and the adults, as moths, in 48. This last is a somewhat unusual showing, as adult moths and butterflies are not a favorite food with birds in general. It is evident that the larvæ—i. e., caterpillars, are generally preferred to the adult insects, but the fact that the adults can fly and so can be taken on the wing apparently recommends them to birds that take their food in the manner of flycatchers. The aggregate of this food for the year is 21.38 per cent, a somewhat larger showing than that of any other of the flycatchers under consideration. Two

stomachs were entirely filled with caterpillars and in several others they exceeded 90 per cent. As practically all caterpillars are harmful it is evident that this bird is doing a good work.

Dragon flies, lace-winged flies, and a few other odd insects make up 4.14 per cent. Dragon flies were found in 18 stomachs, which is a large record, for such agile insects can be taken only by very active birds. Spiders were found in 47 stomachs, and while these creatures are eaten frequently but in small quantites, 1 stomach was filled with them, and in another they amounted to 77 per cent of the contents. Altogether they amount to 4.03 per cent of the food. Three stomachs contained the bones of a lizard (*Anolis carolinensis*). These, with a few eggshells, make up 0.74 per cent and complete the animal food.

Following is a list of the animal food identified in the stomachs:

HYMENOPTERA (bees and wasps).

Limneria sp	1	*Tiphia inornata*	1
Ophion bilineata	1	*Myzine* sp	1
Ophion sp	1	*Chrysis* sp	2
Glypta rufiscutellaris	1	*Halictus* sp	1
Ephialtes sp	1	*Nomada* sp	1
Ichneumon sp	1	*Bombus* sp	1
Camponotus pennsylvanica	1	*Apis mellifera*	1
Camponotus sp	1		

COLEOPTERA (beetles).

Cicindela 6-guttata	1	*Cotalpa lanigera*	2
Agonoderus pallipes	1	*Euphoria sepulchralis*	1
Adalia bipunctata	1	*Euphoria inda*	9
Cucujus clavipes	1	*Elaphidion* sp	2
Hololepta fossularis	1	*Strangalia luteicornis*	1
Ips fasciata	3	*Typocerus zebratus*	4
Elater nigrinus	1	*Monohammus* sp	1
Melanotus communis	1	*Dorcaschema alternatum*	1
Melanotus sp	2	*Liopus variegatus*	1
Limonius griseus	1	*Œdionychis petaurista*	1
Limonius auripilis	1	*Colaspis brunnea*	1
Corymbites hieroglyphicus	2	*Nodonota* sp	1
Dicerca sp	1	*Gastroidea* sp	1
Pœcilonota cyanipes	1	*Odontota dorsalis*	2
Chauliognathus marginatus	1	*Coptocycla bicolor*	1
Phanæus carnifex	1	*Epitragus tomentosus*	1
Onthophagus hecate	1	*Meloe angusticollis*	1
Aphodius fimetarius	4	*Attelabus bipustulatus*	1
Trox sp	1	*Tanymecus lacæna*	1
Dichelonycha subvittata	2	*Artipus floridanus*	2
Dichelonycha elongata	1	*Anthonomus signatus*	1
Dichelonycha sp	4	*Anthonomus grandis*	2
Lachnosterna sp	2	*Læmosaccus plagiatus*	2
Anomala oblivia	1	*Conotrachelus nenuphar*	2
Anomala marginata	1	*Conotrachelus* sp	1
Anomala sp	1	*Balaninus* sp	6

DIPTERA (flies).

Syrphus sp	1	*Tabanus* sp	2

LEPIDOPTERA (butterflies, moths).

Nadata gibbosa	1	*Dryocampa rubicunda*	1

HEMIPTERA (bugs).

Sinea diadema	7	*Brochymena arborea*	5
Metapodius femoratus	1	*Smilia* sp	1
Nezara hilaris	5	*Ceresa bubala*	1
Nezara sp	1	*Thelia uhleri*	1
Euschistus sp	1		

ORTHOPTERA (grasshoppers and crickets).

Scudderia sp	1	*Tettix* sp	2

NEUROPTERA (lace-winged flies, etc.).

Chrysopa sp	2	*Mantispa* sp	1

VERTEBRATE.

Lizard (*Anolis carolinensis*)	3

Vegetable food.—The vegetable food consists of small fruits and a little rubbish. Thirteen different species of fruit were identified, but no one was eaten to a much greater extent than the others. Some fruit was eaten in every month except April, but more than half of all was taken in August, when it amounts to 16.62 per cent of the food of that month. For the year it aggregates 5.36 per cent. Rubbish is only 0.94 per cent and is probably accidental.

The following fruits were found in the stomachs:

Mulberry (*Morus* sp.)	3	Grape (*Vitis* sp.)	2
Pokeberry (*Phytolacca decandra*)	2	Rough-leaved cornel (*Cornus asperifolia*)	3
Sassafras (*Sassafras variifolium*)	2	Huckleberry (*Gaylussacia* sp.)	2
Spicebush (*Benzoin æstivale*)	1	Blueberry (*Vaccinium* sp.)	4
Blackberry and raspberry (*Rubus* sp.)	3	Elderberry (*Sambucus canadensis*)	2
Chokecherry (*Prunus virginiana*)	2	Fruit not further identified	3
Wild bird cherry (*Prunus pennsylvanica*)	2		
Virginia creeper (*Psedera quinquefolia*)	1		

Summary.—From the foregoing it is evident that the crested flycatcher does little if any harm. It is a very desirable bird to have about the orchard or garden, since it does not attack any cultivated crop. As its natural nesting site is a cavity in a partially decayed tree, it can probably be induced to nest in properly constructed boxes, if such are placed in the orchard or other suitable situations. Thus it can be induced to live in orchards and woodland not now frequented by it because of the lack of nesting sites, and eventually no doubt a substantial increase in its numbers can be effected.

ASH-THROATED FLYCATCHER.

(*Myiarchus cinerascens.*)

The ash-throated flycatcher occupies the western part of the United States from the Pacific Ocean as far east as Texas and Colorado and as far north as Washington and Utah. Like the kingbirds, it is a bird of the open parklike country, and is particularly partial to the vicinity of abandoned ranches, in the buildings of which it is pleased to build its nest, while it forages in the orchard and about the deserted garden and cattle yards. Normally it builds in natural cavities in trees and in the abandoned holes of woodpeckers.

For the determination of the character of this bird's food only 91 stomachs were available, taken in the months from April to December, inclusive. So few, spread over so long a time, can give only a tentative idea of the food. In the first analysis the food divides itself into 92.32 per cent of animal matter to 7.68 of vegetable. Of the animal portion all but a few spiders is made up of insects, strictly speaking. Some fruits and seeds compose the vegetable part.

Animal food.—The ash-throat is one of the lesser beetle eaters among the flycatchers. Beetles aggregate only 7.26 per cent of the food, and of these 2.15 per cent can be considered as of useful species. These last consist of predaceous ground beetles (Carabidæ), found in 3 stomachs, and a ladybird (Coccinellidæ) in 1. The bird evidently does not hunt for these insects, or it would find more of them. Other beetles belonging to 7 different families were found in 60 stomachs, or two-thirds of the whole number. This raises the question as to the criterion for the palatableness of any article of food—the frequency with which the bird takes it or the amount eaten. Hymenoptera amount to 26.94 per cent and are the largest item of animal food. Wild bees and wasps make up the bulk of this item, with a few of the parasitic species. No honeybees were found. That Hymenoptera are a favorite food is shown by the quantity eaten and by the facts that they were found in 55 stomachs and that they were well distributed over the season.

Hemiptera (bugs) amount to 20.11 per cent, which is the highest record for this item among the flycatchers now considered. Among them were many of those queer beechnut-shaped little bugs commonly known as buffalo tree hoppers (Membracidæ). These creatures are as agile as fleas, and would seem to be too nimble to be taken by most species of birds, but the ash-throat is evidently very successful in catching them, as they were found in 23 stomachs, while the sluggish stinkbugs (Pentatomidæ) were in only 13. Cicadas were found in 13 stomachs, jumping plant lice (Psyllidæ) in 7, leaf hoppers (Jassidæ) in 7, shield bugs (Scutelleridæ) in 1, assassin bugs (Reduviidæ) in 1, and negro bugs (Corimelænidæ) in 1. They were all taken in

the 5 months from April to August, inclusive, and the average per month, if those 5 alone be considered, is 36.19 per cent.

Diptera (flies) amount to 12.83 per cent of the food, and were eaten in every month except August and September, but this exception is probably accidental. Those identified belong to the house-fly family (Muscidæ), the Syrphidæ (*Eristalis tenax*), and the robber flies (Asilidæ). These last were found in 2 stomachs only. Altogether Diptera were found in 24 stomachs. Lepidoptera (moths and their larvæ) were eaten in all the months but 3 (August, September, and October), but this is probably only accidental. A greater number of stomachs might show a regular consumption throughout the season. They amount to 17.11 per cent of the seasonal diet and were found in 29 stomachs. Of these, 22 contained caterpillars and 7 moths. No special pest was identified.

Orthoptera (grasshoppers and crickets) were eaten in the 4 months, April to July, and a few in December. The total is only 5.14 per cent, and the maximum, 18.07 per cent, occurs in July. Raphidians, dragon flies, and spiders together make 2.93 per cent, the balance of the animal food. The first-named are queer, long-necked, grotesque-looking creatures found in this country only in the far West. They are carnivorous in their habits and are said to prey upon the codling moth. In any event, they do not appear to be numerous in this country at present, and the only specimens the writer ever collected were in the stomachs of birds. The ash-throat appears to eat more of them than any bird yet examined, as they were found in 10 stomachs. One stomach contained 5, and in all there were 16 individuals. Dragon flies were found in 6 stomachs, about the usual proportion for a flycatcher, and spiders in 17, a rather large showing for such sedentary creatures.

Vegetable food.—The vegetable food of the ash-throat may all be summed up in two words, fruit and seeds. Elderberries (Sambucus) were found in 5 stomachs, cissus in 1, black nightshade (Solanum) in 1, fruit not identified in 2, and seeds unknown in 3.

Food of nestlings.—Besides the examination of the stomachs of the ash-throated flycatcher some observations were made on the feeding of nestlings. A nest of 4 young, about a week old when first observed, was watched in hour periods for several days, and the results are given in tabular form below.

Date.	First and last feeding during hour.	Number of feedings.	Date.	First and last feeding during hour.	Number of feedings.
1906.			1906.		
June 18	12.59 p. m.— 1.45 p. m.	9	27	5.15 a. m.— 6.13 a. m.	28
22	10.48 a. m.—11.39 a. m.	14	27	11.27 a. m.—12.22 p. m.	9
22	2.07 p. m.— 3.07 p. m.	9	27	4.47 p. m.— 5.26 p. m.	9
26	2.13 p. m.— 3.11 p. m.	18	28	5.26 a. m.— 6.18 a. m.	16
26	5.56 p. m.— 6.21 p. m. (half hour).	7			119

Average number of feedings per hour, 14. After the first hour's feeding on the morning of June 27, the mother bird was accidentally shot, but the father carried on the feeding to a successful issue, and the young left the nest about noon on the 28th.

Summary.—In its animal food the ash-throat destroys a great number of harmful insects and a few beneficial ones, so that the balance is greatly in the bird's favor. Its vegetable food has absolutely no economic interest.

PHŒBE.

(*Sayornis phœbe.*)

There are but few birds in the United States more endeared to the rural and village population than the common phœbe (Pl. IV). Its habit of associating itself with man and his works, its trustful disposition, and the fact that it is never seen to prey upon any product of husbandry have rendered it almost sacred. It is distributed over the eastern United States as far west as central Texas, northern New Mexico, and Nebraska, and extends north into British America, where it spreads farther west than it does in the United States. It breeds in the whole of this region except the southern parts of the Gulf States. It spends the winter in the Gulf States and beyond our southern boundary. It is not generally a bird of the forest, but lives about farms and gardens, where it chooses a nesting site in crannies of buildings or walls, under bridges, in quarries, or in other similar sheltered places. As the bird is very partial to the vicinity of water, a bridge naturally becomes a favorite nesting place, and from this habit it is often spoken of as the "bridge phœbe." As the phœbe is in such close association with man and spends a large portion of the year in fields and gardens, it follows that its food is likely to be of considerable economic interest. For its investigation 370 stomachs were available, collected in 19 States, the District of Columbia, and Canada. They represent every month in the year and are fairly well distributed.

The food was found to consist of 89.23 per cent of animal matter to 10.77 of vegetable. The animal portion is composed of insects, with some spiders and myriapods, a gordius, and one bone of a tree frog. The vegetable part is made up of small fruits or berries, with a few seeds, all of them probably of wild species.

Animal food.—Useful beetles, consisting of tiger beetles (Cicindelidæ), predaceous ground beetles (Carabidæ), and ladybirds (Coccinellidæ), amount to 2.68 per cent. Other beetles, belonging to 21 families that were identified, make up 12.65 per cent. They appear to be eaten very regularly in every month, but the most are taken in spring and early summer. May is the month of maximum consumption with 23.67 per cent. Beetles altogether amount to

15.33 per cent, which places them as second in rank of the items of animal food. The notorious cotton-boll weevil (*Anthonomus grandis*) was found in 6 stomachs taken in the cotton fields of Texas and Louisiana, and 5 individuals of the strawberry weevil (*A. signatus*) were taken from one collected in Texas. Many of the other beetles contained in the stomachs are by nature equally harmful, but are not so widely known. Such are the corn leaf-beetle (*Myochrous denticollis*), which feeds upon corn; also the 12-spotted cucumber beetle (*Diabrotica 12-punctata*) and the striped cucumber beetle (*D. vittata*), both of which seriously injure and sometimes destroy cucumber and squash vines. The locust leaf miner (*Odontota dorsalis*) has been referred to before. It is sometimes so numerous that all the locust trees over large areas are blasted as by fire.

In the phœbe's diet Hymenoptera stand at the head, as is the case with most of the flycatchers. They are eaten with great regularity and are the largest item in nearly every month. A few of them are the useful parasitic species, which are, however, offset by quite a number of sawfly larvæ, which are very harmful insects. Ants, which are a nuisance, were found in 24 stomachs. No honeybees were identified, but testimony has been received to the effect that the phœbe sometimes eats bees. The following is from a letter written to the Biological Survey by Mr. S. J. Walcott, and dated at Waverly, N. Y., November 30, 1891:

> Having an apiary attached to our place, have often watched common phœbe birds gorge themselves to repletion with honeybees and in two minutes eject the entire mass through the mouth and again resume business with their former relish, and continue this practice for a long time, thereby weakening and sometimes entirely annihilating healthy colonies of bees.

The maximum amount of Hymenoptera was taken in August, when they aggregated 39.66 per cent. They constituted the entire contents of 7 stomachs, and were found altogether in 225, which would seem to establish these insects as the favorite food of the phœbe. In bulk they amount to 26.69 per cent of the yearly diet.

Diptera aggregate 6.89 per cent, and are a very constant, though small, element of the food. The maximum occurs in June, when they amount to 17.90 per cent. The minimum of 1.40 per cent comes in December, when, as is well known, flies are not very abundant. The long-legged crane flies (Tipulidæ), a few horseflies (Tabanidæ), some house flies (Muscidæ), and several other families make up this item. They were found in 79 stomachs and although they do not appear to be very appetizing, they constituted the entire contents of 3 stomachs. Hemiptera (bugs) seem to be sought for rather more than flies, as they were found in 151 stomachs, but only 1 was entirely filled with them. Very curiously these were leaf hoppers (Jassidæ), lively little creatures that live on grass and leaves and jump

like fleas. In all, 16 families were represented in the stomachs, but stinkbugs (Pentatomidæ) take the lead, being found in 42. Bugs are most sought by this bird in the winter months, probably because in summer other and more appetizing insects can be obtained. Half of all that were eaten were taken from November to February, inclusive, but a fair percentage was found in the stomachs of every month. The average for the year is 10.38 per cent.

Orthoptera (grasshoppers and crickets) form 12.91 per cent of the phœbe's food, but are eaten very irregularly, and while found in the stomachs of every month they vary greatly from one month to the next, and are found in the greatest amount when least expected. January is the month which shows the highest consumption, 24.19 per cent, while July is practically the same, 24.15 per cent. August, which with most eastern birds is the great month for eating grasshoppers, in this case shows only 6.37 per cent, while in June only 1.50 per cent were taken. There is no apparent logical reason for this irregularity. It is probably an accident, and a larger amount of material would almost surely give a more even result. Grasshoppers were found in 125 stomachs, crickets in 23, and locusts in 6, which would seem to indicate a reasonable fondness for this order of insect. The only kind that was specifically identified was the red-legged grasshopper (*Melanopus femur-rubrum*), a well-known and very destructive insect.

Lepidoptera (moths and caterpillars) are eaten much more regularly than grasshoppers, but not in such large quantities. They amount to 8.86 per cent of the food of the year, and were found in 118 stomachs, of which 47 contained adult moths and 71 held caterpillars. One stomach was entirely filled with a large moth. June, with 14.90 per cent, was the month of greatest consumption, but all the months show a fair percentage and none of them fall greatly below the average. A few miscellaneous insects, such as dragon flies, caddis flies, and ephemerids, amount to 2.39 per cent, and while not eaten extensively were taken to some degree in every month.

Spiders constitute quite a steady article of the phœbe's diet. Ticks and millepeds also are eaten. None of these creatures can be taken when they are on the wing, as they can not fly, but spiders may sometimes be picked up when they are sailing through the air upheld by their gossamer threads or they may be found on the top of a tall reed as the bird flies past. But ticks and millepeds must be taken from the ground or some other surface. The aggregate of these creatures for the year is 5.78 per cent. March is the month of greatest consumption with 11.94 per cent, but April stands nearly as high, while every month shows a fair percentage except June, which has but 1 per cent. Spiders were found in 76 stomachs, millepeds in 7,

PHOEBE

wood ticks (*Ixodes scapularis*) in 2, and a cattle tick (*Margaropus annulatus*) in 1. Maj. Bendire says:

> Dr. Ralph tells me that in Florida the phœbe frequently alights on the backs of cattle and follows them around, catching the flies on these animals and fluttering above them in search of insects.[1]

This may possibly explain the presence in the stomachs of such unlooked-for creatures as ticks. The stomachs from which the ticks were taken were collected in Florida.

The following animal food was identified in the stomachs:

HYMENOPTERA.

Megachile sp	1	*Camponotus pennsylvanicus*	3
Andrena sp	2	*Ichneumon* sp	1
Halictus sp	4	*Cryptus* sp	4
Crabro sp	1	*Mesostenus* sp	1
Vespa maculata	1	*Ophion* sp	2
Chrysis sp	1	*Campoplex* sp	1
Myzine sp	3	*Limnerum* sp	1
Myrmica scabrinodis	1	*Paniscus* sp	1
Aphænogaster sp	3	*Exetastes* sp	1

COLEOPTERA.

Cicindela 6-guttata	1	*Chauliognathus pennsylvanicus*	1
Cicindela 16-punctata	1	*Chauliognathus marginatus*	4
Cicindela repanda	1	*Telephorus bilineatus*	1
Pterostichus sp	1	*Collops 4-maculatus*	1
Amara exarata	1	*Canthon lævis*	1
Amara sp	1	*Canthon viridis*	2
Platynus 4-dentatus	1	*Copris minuta*	2
Platynus sp	2	*Onthophagus hecate*	5
Chlænius sp	1	*Onthophagus tuberculifrons*	1
Anisodactylus rusticus	2	*Onthophagus pennsylvanicus*	4
Anisodactylus sp	2	*Onthophagus* sp	4
Hydroporus undulatus	1	*Atænius imbricatus*	1
Hydrophilus glaber	1	*Atænius cylindrus*	2
Megilla maculata	3	*Aphodius fimetarius*	19
Hippodamia convergens	1	*Aphodius granarius*	1
Coccinella 9-notata	3	*Aphodius inquinatus*	19
Adalia bipunctata	2	*Aphodius bicolor*	1
Anatis 15-punctata	5	*Aphodius* sp	8
Hister depurator	1	*Dichelonycha* sp	1
Ips fasciatus	3	*Macrodactylus subspinosus*	1
Cytilus sericeus	1	*Diplotaxis* sp	3
Drasterius elegans	2	*Lachnosterna* sp	1
Dolopius marginatus	1	*Valgus caniliculatus*	1
Melanotus sp	1	*Phymatodes* sp	1
Limonius griseus	1	*Liopus* sp	1
Limonius quercinus	1	*Pogonocherus* sp	1
Chrysobothris sp	1	*Orsodachna atra*	2

[1] Life Histories of North American Birds, II, p. 273, 1895.

Lema trilineata	2	*Phyxelis rigidus*	1
Chlamys plicata	2	*Cercopeus chrysorrhœus*	1
Crytocephalus venustus	1	*Tanymecus lacæna*	1
Myochrous denticollis	2	*Macrops* sp	1
Diabrotica 12-punctata	3	*Anthonomus signatus*	1
Diabrotica vittata	1	*Anthonomus grandis*	6
Galerucella sp	3	*Conotrachelus posticatus*	1
Blepharida rhois	1	*Chalcodermus* sp	1
Disonycha caroliniana	2	*Acalles carinatus*	1
Odontota dorsalis	1	*Rhinoncus pyrrhopus*	1
Odontota sp	2	*Balaninus victoriensis*	1
Chelymorpha cribraria	1	*Balaninus* sp	7
Blapstinus sp	1	*Sphenophorus compressirostris*	1
Tricrania sanguinipennis	1	*Sphenophorus* sp	2
Negalius marmoratus	1	*Rhodobænus 13-punctatus*	1
Epicauta pennsylvanica	1		

DIPTERA.

Scatophaga stercoraria	1	*Eristalis* sp	1

HEMIPTERA.

Cicada sp	2	*Metapodius femoratus*	1
Oncometopia undata	1	*Myodocha serripes*	1
Aulacizes irrorata	1	*Nabis subcoleoptratus*	2
Aulacizes lateralis	1	*Sinea diadema*	5
Tettigonia sp	1	*Milyas cinctus*	1
Euschistus sp	1	*Hygrotrechus* sp	4
Brochymena sp	1		

ORTHOPTERA.

Melanoplus femur-rubrum	1	*Tettix* sp	10

ODONATA.

Agrion sp	1

ACARINA.

Ixodes scapularis	2	*Margaropus annulatus*	1

Vegetable food.—The vegetable food of the phœbe may be placed in two categories, fruit and seeds. Fruit amounts to 4.99 per cent. In May and June, the months of strawberries and cherries, no fruit at all was taken. In July 1 per cent was eaten, and from this point it increases slowly to December and January, with 10.73 and 10.84 per cent, respectively. The only thing found suggestive of cultivated fruit was the seeds of blackberries or raspberries contained in 5 stomachs. Of small wild berries 17 species were identified, besides a number of seeds, but nothing of any economic value was found. There were several species of seeds, but the only ones of interest were the poison ivy and poison sumac, whose seeds the birds distribute,

but they were found in only a few stomachs. The great bulk of the vegetable food was taken in the fall, winter, and early spring months.

The following fruit, seeds, etc., were identified in stomachs of the phœbe:

Juniper (*Juniperus virginiana*)	1	Dwarf sumac (*Rhus copallina*)	1
Panic grass (*Panicum* sp.)	1	Smooth sumac (*Rhus glabra*)	2
Greenbrier (*Smilax bona-nox*)	2	Poison ivy (*Rhus toxicodendron*)	12
Bayberry (*Myrica carolinensis*)	15	Poison sumac (*Rhus vernix*)	1
Wax myrtle (*Myrica cerifera*)	4	Sumac sp. (*Rhus* sp.)	20
Mississippi hackberry (*Celtis mississippiensis*)	1	Dahoon holly (*Ilex cassine*)	2
Western hackberry (*Celtis occidentalis*)	2	Virginia creeper (*Psedera quinquefolia*)	1
Smartweed (*Polygonum* sp.)	1	Rough-leaved dogwood (*Cornus asperifolia*)	2
Pokeberry (*Phytolacca decandra*)	4	Blueberry (*Vaccinium* sp.)	3
Carolina moonseed (*Cocculus carolinus*)	1	Persimmon (*Diospyros virginiana*)	1
Fever bush (*Benzoin benzoin*)	1	Horse sugar (*Symplocos tinctoria*)	1
Sassafras (*Sassafras variifolium*)	2	Virginia plantain (*Plantago virginica*)	1
Shadbush (*Amelanchier canadensis*)	2	Arrowwood (*Viburnum dentatum*)	1
Blackberry or raspberry (*Rubus* sp.)	5	Elderberry (*Sambucus* sp.)	4
Wild black cherry (*Prunus serotina*)	2	Ragweed (*Ambrosia* sp.)	1
Cassia (*Cassia* sp.)	1	Fruit not further identified	22

Food of nestlings.—Among the stomachs examined were those of four newly hatched nestlings, which merit passing notice. The stomachs contained no vegetable matter whatever, but were completely filled with insects and spiders. The largest item was young grasshoppers, which constituted 63.75 per cent of the contents of the four stomachs. Next to these were spiders, which amount to 14.25 per cent. Flies, partly in the shape of grubs or maggots, came next with 9.75 per cent. Hymenoptera (wasps) amount to 5.25 per cent; caterpillars, to 4.50; two beetles, one adult the other larval, to 1.75; and parts of a bug and a moth, to 0.75. Note the soft character of the food. The grasshoppers were all young, partly grown, and very soft bodied. The spiders and caterpillars also were soft, the Hymenoptera were somewhat harder, but the only really hard food was the one adult beetle.

Summary.—It seems hardly necessary to say anything in favor of a bird already firmly established in the affections of the people, but it may not be amiss to point out that this good will rests on a solid foundation of scientific truth. In the animal food of the phœbe there is such a small percentage of useful elements that they may be safely overlooked; while of the vegetable food it may be said that the products of husbandry are conspicuous by their absence. Let the phœbe remain just where it is. Let it occupy the orchard, the garden, the dooryard, and build its nest in the barn, the carriage house, or the shed. It pays ample rent for its accommodations.

SAY'S PHŒBE.

(*Sayornis sayus.*)

Say's phœbe is an inhabitant of western North America from the Pacific Ocean eastward as far as western Texas, Kansas, and Nebraska, and extends northward into Alaska. In the warmer southwestern portions of the country it usually migrates northward, or else goes up into the hills or mountains in the breeding season. For this reason it is not often seen in the valleys in California during the summer. It is a bird mostly of the open, though sometimes taken in timber country. After the season of reproduction the pairs apparently separate, and each alone is engaged in its perpetual hunt for insects. It is domestic in its tastes, and in California, when it returns from its summer range, it is apt to attach itself to some house or other building and remain in that immediate vicinity all winter, roosting at night in a cranny under the cornice or wherever it can find snug, covered quarters.

For the determination of this bird's food, 111 stomachs were taken, representing every month of the year, but while too few to give exact results, they will probably fix the bird's economic status with a reasonable degree of accuracy. In the first analysis the food was found to consist of 99.78 per cent of animal food to 0.22 per cent of vegetable.

Animal food.—Beetles of the three most useful families—Cicindelidæ, Carabidæ, and Coccinellidæ—amount to 5.95 per cent of the food. This is a surprisingly large percentage to be eaten by a flycatcher. They were found in every month except May and July, and these months would no doubt have shown some had there been more stomachs. They were found in 5, 26, and 15 stomachs, respectively; that is to say, the greatest flyers, the cicindelids, which one would suppose to be the most easily taken by a flycatcher, are chosen the least, and the coccinellids, which live on trees and fly sluggishly, are taken less than the carabids, that live almost wholly upon the ground. Other beetles amount to 9.72 per cent, and are either harmful or neutral species.

Hymenoptera are the largest item of food, and with a greater number of stomachs would undoubtedly hold that rank in every month. We have, however, only two stomachs taken in May and one in July, and these contain no Hymenoptera at all. In all the other months there is a good percentage, and the average for the year is 30.72 per cent. They are mostly bees and wasps, with a few ants. No honeybees were found.

Hemiptera are eaten very irregularly and in small quantities. The total amounts to 4.45 per cent. Five families were represented,

but the stinkbugs (Pentatomidæ) were contained in the most stomachs.

Diptera (flies) appear to be more popular than bugs with Say's phœbe. The aggregate is 16.67 per cent, while for the eight months in which they were eaten the average amount is 25 per cent. The kinds eaten are mostly of the families of the house fly, the crane fly, and the robber fly. One stomach was entirely filled with members of the house-fly family (Muscidæ).

Caterpillars and moths amount to 12.12 per cent of the diet of Say's phœbe. Here for the first time is found a flycatcher that eats more of the adults (moths) than it does of the larvæ (caterpillars). The former were found in 19 stomachs and the latter in 17. None were in the stomachs of July and August, but as only three stomachs were collected in those months, the record can not be accepted as final. Most of the other months show a fair percentage, and May and June appear to be the months of greatest consumption. Grasshoppers and crickets seem to be well liked, as they occurred in 48 stomachs, were the total contents of one, and amount to 15.36 per cent of the food. They are probably eaten in every month, but none were found in the few stomachs taken in January, June, and July. The average for the nine months in which they occur is over 20 per cent. Dragon flies, spiders, millepeds, and a few sowbugs, together amount to 4.79 per cent of the food, and make up the remainder of the animal quota.

The following animal food was identified in the stomachs:

COLEOPTERA.

Cicindela lemniscata	1	*Euphoria inda*	1
Dyschirius gibbipennis	1	*Leptura instabilis*	1
Amara interstitialis	2	*Gastroidea* sp	1
Amara sp	1	*Œdionychis miniata*	1
Anisodactylus rusticus	1	*Haltica foliacea*	1
Hippodamia convergens	2	*Blapstinus* sp	3
Coccinella californica	3	*Epicauta stuarti*	1
Hister ulkei	1	*Thecesternus humeralis*	1
Collops argutus	8	*Mylacus saccatus*	1
Aphodius inquinatus	3	*Sitones* sp	1
Aphodius sp	2		

DIPTERA.

Cyrtopogon bimacula	1	*Lucilia* sp	1
Cynomyia cadaverina	1		

ORTHOPTERA.

Melanoplus sp	2

CRUSTACEA.

Oniscus sp	1

Vegetable food.—The vegetable food of Say's phœbe can be dismissed with a few words. It consists of seeds of elder (Sambucus) contained in 3 stomachs, nightshade (Solanum) in 2, a single seed of a fig in 1, seeds of tarweed (Madia) in 1, and rubbish in 4. Thus it has no economic importance.

The following fruits were identified:

Elderberry (*Sambucus glauca*)	3	Black nightshade (*Solanum nigrum*)	2
Tarweed (*Madia sativa*)	1	Fig (*Ficus*)	1

Summary.—It is evident that the animal food is the factor that fixes this bird's economic position. The item of this most open to criticism is the three families of predatory beetles. This item is higher with Say's phœbe than with any other of the flycatchers, but still is small as compared with the injurious insects eaten. It is evident that in spite of the fact that the bird eats these useful insects its work on the whole is beneficial, and it should be protected.

BLACK PHŒBE.

(*Sayornis nigricans.*)

The black phœbe (Pl. V) would seem to have extended its range from Mexico into the United States along the southern border and on the west coast. In California it is confined chiefly to the region west of the Sierra Nevada, and its range extends for a short distance into Oregon. Farther south it is found east as far as central Texas. It inhabits the valleys and is resident throughout the year. Like many other flycatchers, it is very partial to the vicinity of water, and every stream or pool, and even the watering trough by the roadside, will be found to have its attendant phœbe. It is as domestic as its eastern relative, and habitually builds its nest under the eaves or in crannies of buildings, and where these are surrounded by a large stockyard with a plentiful supply of water the conditions appear to be ideal. Bridges, overhanging banks of streams, and rock cliffs also are favorite nesting sites.

While camping beside a stream in California the writer observed the feeding habits of the black phœbe. The nesting season was over, and apparently the birds had nothing to do but look for food, and this they appeared to do all the time. At the first gleam of daylight a phœbe could always be seen flitting from rock to rock, and probably it caught an insect on each flight. This activity was kept up all day, and even after supper, when it was so dark that notes could be written only by the light of the camp fire, the phœbes were still hunting insects. Up and down this stream there was a phœbe at every 10 or 12 rods patrolling for insects.

Observations like these are convincing evidence that the number of insects destroyed in a year by this species is enormous, and the

examination of stomachs confirms field observations. But few flycatchers, or birds of any kind, devour a larger percentage of insect food than the black phœbe. It is not at all improbable that this species and many others seldom or never take vegetable food intentionally. In many cases the vegetable substance found in the stomachs is mere rubbish accidentally picked up with insects. Bees and wasps often light on berries to suck the juice, and a bird making a quick snap at such an insect might take berry and all, and when the seeds were found in its stomach it might be charged with having intentionally eaten the fruit.

For the laboratory investigation of this bird's food 344 stomachs were available, all but one collected in California, but distributed through every month of the year. The food was found to consist of 99.41 per cent of animal matter to 0.59 per cent of vegetable.

Animal food.—Useful beetles belonging to the three families Cicindelidæ, Carabidæ, and Coccinellidæ were found in 15 stomachs and amount to 2.82 per cent of the food. Other beetles of harmful or neutral species were found in 41 stomachs and reach 10.50 per cent. Hymenoptera form the largest item of the food. They were found in 247 stomachs and were the whole contents of 15. There is a good percentage in every month except March and April, and these exceptions are probably accidental. As would naturally be expected, the greatest amount is eaten in August, when it aggregates 58.75 per cent of the food. The average for the year is 30.82 per cent. A few parasitic species were noted, but they were too few to make a respectable percentage. Ants were found in 48 stomachs, and for a short time in midsummer constitute quite a notable part of the food. Various wild bees and wasps make up the bulk of this item. No honeybees were found.

Hemiptera, or bugs in various forms, constitute 10.56 per cent and were found in the stomachs of every month but May. December is the month of greatest consumption and April and May of least. They were found in 92 stomachs, and 13 families were identified. Pentatomidæ, or stinkbugs, appear to be the favorites, as they were contained in 10 stomachs, the most of any family. Plant lice (Aphidæ) were found in 1 stomach. Diptera, or flies, amount to 28.26 per cent and form the second largest item. They were found in 97 stomachs and completely filled 3. They constitute the most regular article in the black phœbe's diet. Every month has a good percentage, except perhaps August, which shows only 4.92, but the next one is July, with 11.47, and all the others are higher. The maximum occurs in April at 64.36 per cent. The black phœbe fairly merits its title of flycatcher.

Lepidoptera (moths and caterpillars) amount to 8.22 per cent of the food. They were found in 72 stomachs, of which 51 contained

the adult moths and 28 the larvæ or caterpillars. One stomach was entirely filled with the adults. This is one of the few birds studied by the writer that eats more moths than caterpillars, for as a rule the caterpillars are largely in excess. Naturally the flycatchers, taking their food upon the wing, would prove exceptions to the rule. Grasshoppers and crickets are evidently not a favorite food of the black phœbe, as they amount to only 2.45 per cent. They were found in 39 stomachs, but usually the amount in each was small, though 1 stomach was entirely filled with them. They were taken in the months from June to October, with a small percentage in February and April. Dragon flies, white ants (Termes), a few unrecognizable fragments of insects, and spiders amount to 5.78 per cent, the balance of the animal food. Dragon flies were found in 63 stomachs, or 18 per cent of the whole—the largest record for these insects yet noted. The wonder is that they do not amount to a greater percentage.

The following insects were identified:

COLEOPTERA.

Elaphrus riparius	1	*Heterocerus tristis*	1
Triæna longula	2	*Canthon* sp	1
Bradycellus rupestris	1	*Onthophagus* sp	2
Tropisternus sp	1	*Aphodius fimetarius*	1
Laccobius ellipticus	1	*Aphodius granarius*	1
Philonthus pubes	1	*Aphodius vittatus*	2
Hippodamia convergens	7	*Aphodius ungulatus*	1
Hippodamia ambigua	1	*Aphodius* sp	6
Coccinella californica	2	*Amphicoma ursina*	2
Chilocorus orbus	1	*Gastroidea* sp	1
Cryptorhopalum apicale	1	*Lina scripta*	1
Hister bimaculatus	1	*Diabrotica soror*	2
Saprinus obscurus	1	*Blapstinus pulverulentus*	2
Saprinus lugens	2	*Blapstinus* sp	4
Saprinus lubricus	2	*Corphyra* sp	1
Saprinus fimbriatus	1	*Notoxus alamedæ*	1
Carpophilus hemipterus	1		

HEMIPTERA.

Largus succinctus	1

Vegetable food.—Seeds of elderberries were found in 16 stomachs and were probably taken intentionally. Seeds of Rubus (blackberry or raspberry) were found in 1 stomach, seed of dogwood (Cornus) in 1, 1 seed of poison oak in each of 3 stomachs, seed of filaree in 1, seeds unknown in 5, fruit pulp in 1, catkin in 1, and rubbish in 6. It all amounts to 0.59 per cent, and certainly has little economic interest.

The following fruits and seeds were identified:

Elderberry (*Sambucus glauca*)	16	Raspberry or blackberry (*Rubus* sp)	1
Dogwood (*Cornus pubescens*)	1	Poison oak (*Rhus diversiloba*)	3
Filaree (*Erodium* sp.)	1		

BLACK PHOEBE.

Food of nestlings.—Among the stomachs involved in the foregoing discussion are those of 22 nestlings varying in age from 1 to 2 weeks. These were separately tabulated, and show some differences from the diet of the adults. The food consisted of 98.86 per cent of animal matter to 1.14 of vegetable. This is apparently more than twice as much vegetable matter as was taken by the adults, but nearly all of t was rubbish, probably given to the young accidentally. Only 1 stomach contained a little fruit pulp—real food. Beetles, which are hard food, amount to 3.14 per cent. Hymenoptera, which are softer and much more easily crushed and broken up, aggregate 44.68 per cent. Hemiptera (bugs) were fed to 1 nestling only. It was 17 per cent of that stomach's contents, but amounts to only 0.77 per cent of the whole food. Diptera, which are softer than Hymenoptera, were fed to the amount of 34.73 per cent. In 1 brood of 3 the average in each stomach was 75 per cent, and in another brood of 3 the average was 82 per cent. In 2 other broods none at all were found. Lepidoptera reached a percentage of 8.23 per cent, but were irregularly distributed; that is, they were fed to only 6 of the 22 birds, but to an average extent of over 30 per cent to each. Crickets were fed to but 1 of the nestlings, but in that 1 they amounted to 85 per cent, making an average of 3.86 per cent for all. Dragon flies were fed to 3 birds of different broods to the extent of 10, 15, and 30 per cent, respectively. The average for the 22 is 2.50 per cent. It will be noted that the nestlings' food is on the whole composed of much softer constituents than that eaten by the adults. If we take the three softest elements—Hymenoptera, Diptera, and Lepidoptera—we find that they aggregate 87.64 per cent of the whole food.

Summary.—While the black phœbe does not improve every opportunity to destroy harmful insects, it certainly neglects many chances to eat useful ones. The destruction of a few predaceous beetles, dragon flies, and parasitic Hymenoptera are the sum of its sinning. So far as the writer knows, this bird is welcomed and protected everywhere throughout its range, which is as it should be.

OLIVE-SIDED FLYCATCHER.

(*Nuttallornis borealis.*)

The olive-sided flycatcher appears to be an inhabitant of North America at large, but is nowhere very abundant. It breeds in scattered localities throughout the United States; in the southern part only in the mountains. It shows a decided preference for mountainous regions and coniferous forests; consequently it is not often seen about orchards and gardens and does not usually come in contact with crops. Interest in its food, therefore, is to a certain degree academic. Its food habits, however, are notable from the fact that this species represents the extreme of the flycatcher type. Of the

17 species treated in this bulletin Hymenoptera form the largest item in the stomachs of 13, and may therefore be considered as the typical food of flycatchers. In the consumption of Hymenoptera the olive-sided stands at the head. Nevertheless, Maj. Bendire, in speaking of this bird, says:

> Like all flycatchers, their food consists almost exclusively of winged insects, such as beetles, butterflies, moths, and the numerous gadflies which abound in the places frequented by these birds.[1]

Examination of the stomachs of this species shows that the 3 orders specially referred to amount to less than 12 per cent of its food—another instance of the incompleteness of field observation upon the diet of birds.

In the investigation of this bird's food 69 stomachs were collected in 12 States, Ontario, Nova Scotia, and New Brunswick during the months from April to September. They are distributed across the continent from New Brunswick to Washington, and as far south as Texas. In the first analysis the food was found to consist of 99.95 per cent of animal food and 0.05 per cent of vegetable. This minute portion of vegetable matter is of so little importance that it may be disposed of at once. It consists of fruit pulp, not further identified, to the amount of 3 per cent, and some spruce foliage and other rubbish, all found in 1 stomach collected in Colorado in the month of July. The two latter items amount to 1 per cent, and may both be properly classed as rubbish, probably swallowed accidentally.

Animal food.—Useful beetles were found in 3 stomachs and amounted to 0.45 per cent of the food. They consisted of 1 tiger beetle (Cicindelidæ) and 2 predaceous ground beetles (Carabidæ) and were found in the 3 months of May, July, and August. Beetles belonging to harmful families were found in the diet of every month and amounted to 5.79 per cent of the food. Among these beetles were 2 specimens of the cotton-boll weevil (*Anthonomus grandis*) from the stomach of a bird taken near a cotton field in Texas. Hymenoptera are the staff of life of the olive-sided flycatcher and form a large percentage of the food of each month. The fewest were taken in May, when they amounted to 74.50 per cent. The average consumption for the season from April to September was 82.56 per cent. They were found in 61 of the 63 stomachs, and 26, that is, over 41 per cent of the whole, contained no other food. Of all the birds examined by the Biological Survey, not one subsists so nearly exclusively upon one order of insects. Winged ants were found in 10 stomachs and entirely filled 2 of them. A few useful parasitic species were identified, but more interesting than these were 63 honeybees (*Apis mellifera*), found in 16 stomachs, or 25 per cent of the whole number. Of these, 36 were workers and 27 were males or drones. Thus the bird

[1] Life Histories of North American Birds, II, p. 284, 1895.

shows a very decided fondness for hive bees, but not the special preference for drones manifested by kingbirds. Five stomachs taken near an apiary at Riverside, Cal., contained 25 honeybees, or an average of 5 to each stomach, and 2 stomachs contained nothing else. In 1 of these were 8 workers and in the other 4 drones. Altogether in the 5 stomachs there were 16 drones and 9 workers, a number which seems to indicate that where bees are abundant the bird selects drones. From this record it appears that the olive-sided flycatcher would be a menace to the bee-keeping industry were it abundant in the thickly settled portions of the country.

Diptera (flies) were found in 3 stomachs in July and 1 in September. The amount for the season (April to September) is 0.88 per cent. Hemiptera (bugs) were eaten in May and June and to a less extent in July and August. The average for the season is 3.25 per cent, all contained in 5 stomachs. Stinkbugs, cicadas, and tree hoppers were the only families identified. Grasshoppers in the diet of this bird were found in only 2 stomachs, 1 taken in May and 1 in July. They constitute 3.36 per cent of the food of the 2 months, or 1.12 per cent for the whole season of 6 months.

Lepidoptera, in the shape of moths, were found in 5 stomachs, and entirely filled 2 of them. They were all taken in the 3 months of June, July, and August, and amount to 4.13 per cent of the food for the season. All of them were adult moths and no trace of a caterpillar was found in any stomach. This presents the extreme case where the adults are eaten to the complete exclusion of the larvæ, but it is evident that Lepidoptera are not a favorite food with the olive-side. Dragon flies were found in 4 stomachs collected in August and September. They amount to 1.77 per cent and complete the quota of animal food.

The following is a list of the insects identified in the stomachs:

HYMENOPTERA.

Apis mellifera	16	*Vespa maculata*	3
Bombus virginicus	1	*Tiphia inornata*	1
Bombus sp	1	*Camponotus pennsylvanicus*	1
Xylocopa virginica	1	*Ichneumon* sp	1

COLEOPTERA.

Amara californica	1	*Aphodius* sp	1
Elater behrensi	1	*Dichelonycha* sp	1
Elater sp	1	*Euphoria sepulchralis*	1
Melanotus longulus	1	*Asemum mœstum*	1
Buprestis aurulenta	1	*Acmæops proteus*	1
Melanophila fulvoguttata	1	*Anthonomus grandis*	1
Onthophagus sp	1	*Balaninus* sp	1
Aphodius fimetarius	3	*Dendroctonus validus*	1

HEMIPTERA.

Cicada sp	2

Summary.—The most prominent fact in the food habits of the olive-sided flycatcher is its consumption of honeybees. As it eats no vegetable matter worth mentioning, its record must rest on its insect food, and honeybees constitute entirely too large a quota for the best economic interests. Were the bird as abundant and as domestic as either of the phœbes, there is no doubt that it would be a pest to bee keepers. At present it probably does little harm, except when, as in the case noted, a number of the birds take up their residence in the vicinity of the apiary and make bees a part of their regular diet.

The food of this bird is interesting, as it represents the food of a typical flycatcher. With the exception of the vegetable matter in 1 stomach, everything it eats could be taken on the wing. Caterpillars, spiders, and millepeds, although found in the stomachs of most flycatchers, are entirely absent.

WOOD PEWEE.

(*Myiochanes virens.*)

During the breeding season the wood pewee inhabits the eastern part of the United States, from central Texas, Kansas, Nebraska, and the Dakotas; its breeding range also extends northward into Canada. In winter it retires southward far beyond the boundaries of the United States and returns north rather late in spring, though 2 stomachs used in this investigation were taken at Bloomington, Ill., on the 5th and 27th, respectively, of March.

It makes its home both in dense forests and in open groves, and in New England, at least, is a frequenter of orchards to such a degree that it has there received the name of orchard phœbe. Although it does not build in hollow trees, it seems to prefer an orchard of old trees, probably because insects are more abundant there. In thickly settled regions it is quite domestic and sometimes lives and nests in village shade trees and forages about gardens.

The bird is well known as a fairly typical flycatcher, but it eats some food that can not be taken on the wing. In writing of this bird Maj. Bendire says:

> Mr. George A. Seagle, superintendent of the Wytheville (Va.) Fish Commission Station, states: "This little bird has frequently been seen to catch young trout from the ponds soon after they had been transferred from the hatching house." [1]

Catching fish is a singular occupation for a flycatcher, and doubtless is highly exceptional. Nothing was found in the stomachs examined indicative of any such food habit. Nevertheless in the stomachs of several other flycatchers the bones of tree frogs and lizards have been noted, so that the case does not appear at all improbable.

[1] Life Histories of North American Birds, II, p. 289, 1895.

The following discussion of the food of the wood pewee is based upon the examination of 359 stomachs taken in 20 States of the Union, the District of Columbia, Ontario, New Brunswick, and Nova Scotia. They were collected in the months from March to October and are well distributed over that time.

The food was found to consist of 98.97 per cent of animal matter to 1.03 of vegetable. The animal food is made up of insects, spiders, and millepeds; the vegetable, of berries and seeds.

Animal food.—Carabidæ and Coccinellidæ, or ground beetles and ladybirds, amount to 3.62 per cent of the food, and this is probably too high, for only 2 stomachs were taken in March, and 1 of these was nearly half full of these beetles, and therefore raised the average for the whole season of eight months. Other beetles constitute 10.61 per cent of the food, and include, among others, such harmful species as the clover-leaf weevil (*Phytonomus punctatus*), the plum curculio (*Conotrachelus nenuphar*), the corn weevil (*Sphenophorus zeæ*), and the rice weevil (*Calandra oryzæ*), besides 6 species of the Scolytidæ, a family which includes some of the worst enemies of forest trees. Between 30 and 40 of these tree destroyers were found in 1 stomach. Beetles belonging to at least 27 families were eaten. They were contained in 220 stomachs and in 5 there was no other food.

Hymenoptera constitute 28.20 per cent of the food, and are eaten largely in every month except March, when only 2 somewhat exceptional stomachs were taken; in fact, were this month omitted, the percentage for the season would rise to 32.15, which is probably much nearer the truth. As has been before observed, the flycatchers take a considerable number of useful parasitic species among the Hymenoptera which they eat. The wood pewee is probably the worst sinner of the family in this respect. In midsummer these useful insects constitute a very considerable proportion of the hymenopterous food and in June amount to about one-third of it. It is safe to say that about one-fourth of the Hymenoptera eaten by the wood pewee are of parasitic species. This, however, is probably not so great a fault as may at first appear, and does not necessarily condemn the bird. Two worker honeybees were identified, 1 in each of 2 stomachs. Hymenoptera were found in 261 stomachs, and 10 stomachs contained nothing else.

Diptera amount to 29.98 per cent of the seasonal diet and are the most regular and constant constituent of the food. A very considerable percentage is eaten in every month, and in September, which is the month of least consumption, Diptera still amount to 15 per cent. In May they aggregate 44.47 per cent, a figure that may be considered as fairly reliable, for 83 stomachs were collected in that month. Diptera were found in 190 stomachs and were the sole contents of 22. Among others, there were recognized the horseflies

(Tabanidæ), the robber flies (Asilidæ), the syrphus flies (Syrphidæ), the tachina flies (Tachinidæ), and a number of long-legged crane flies (Tipulidæ). The great bulk of the dipterous food, however, belonged to the house fly family (Muscidæ). The syrphus and tachina flies are useful insects, but the great majority of members of the fly families are a nuisance and many of them pests, and it is a benefit to the world to have their numbers reduced; in this respect the wood pewee is doing a good work.

Moths and caterpillars (Lepidoptera) are eaten by the wood pewee every month of its stay in the north, but not quite so regularly nor in such quantities as flies. The average for the season of eight months is 12.31 per cent. They were found in 79 stomachs, but no stomach was entirely filled with them. The adult moths were found in 59 stomachs, and the larvæ, or caterpillars, in 21—another instance where the moths eaten much exceed the caterpillars. Owing to their soft bodies none of these insects were well enough preserved to enable the species to be recognized, but, as nearly the whole order is composed of harmful species, identification is not necessary.

Orthoptera (grasshoppers and crickets) are eaten very sparingly and irregularly by the wood pewee. The total for the season (March to October) is 3.44 per cent. They were found in only 33 stomachs, and but 1 contained no other food. These insects are perhaps too large to be successfully managed by so small a bird; moreover, they are not extensive flyers, and some of them do not fly at all, which probably accounts for their rarity in the diet.

Hemiptera (bugs) are eaten in every month of the pewee's stay north, but in small and rather irregular quantities. They were found in 98 stomachs, and not one was completely filled with this kind of food. The families recognized were the tree hoppers (Membracidæ), leaf hoppers (Jassidæ), negro bugs (Corimelænidæ), stinkbugs (Pentatomidæ), squash bug family (Coridæ), assassin bugs (Reduviidæ), and water striders (Hydrobatidæ). All of these are harmful in their habits except the assassin bugs, which destroy caterpillars and other insects, and the water striders, which have no economic significance. The amount for the season is 5.99 per cent of the food.

Miscellaneous insects, nearly all of which are dragon flies, were eaten with remarkable regularity in all the months from May to September. The total for the season is 2.61 per cent. Spiders, with a few millepeds, were taken in every month of the pewee's stay in the north, but rather irregularly. They are probably eaten as makeshifts when better food is wanting, as on rainy days when flying insects are not abroad. They amount to 2.21 per cent of the food, and complete the animal quota.

The following is a list of the insects identified and the number of stomachs in which each was found.

HYMENOPTERA.

Apis mellifera	2	*Camponotus* sp	2
Melissodes sp	1	*Proctotrypes* sp	1
Andrena sp	1	*Pteromalus* sp	1
Halictus sp	1	*Ichneumon* sp	1
Crabro sp	1	*Hemiteles* sp	1
Odynerus sp	1	*Mesostenus* sp	2
Chrysis cæruleans	1	*Ophion bilineatum*	1
Tiphia inornata	5	*Agathis* sp	1
Aphænogaster fulvum	1	*Bracon* sp	1
Camponotus pennsylvanicus	3	*Tremex sericeus*	1

COLEOPTERA.

Elaphrus sp	1	*Onthophagus pennsylvanicus*	2
Clivina striatopunctata	1	*Onthophagus* sp	9
Amara impunctricollis	1	*Atænius* sp	1
Platynus sp	1	*Aphodius fimetarius*	20
Stenolophus fuliginosus	1	*Aphodius ruricola*	1
Tachycellus atrimedius	1	*Aphodius inquinatus*	9
Anisodactylus baltimorensis	1	*Aphodius granarius*	1
Dineutes emarginatus	1	*Aphodius bicolor*	1
Aleochara bimaculata	1	*Aphodius* sp	6
Philonthus longicornis	1	*Dichelonycha elongata*	2
Scaphidium 4-maculatum	1	*Dichelonycha* sp	5
Megilla maculata	1	*Euphoria inda*	1
Coccinella sanguinea	2	*Typocerus velutinus*	1
Adalia bipunctata	1	*Strangalia luteicornis*	1
Anatis 15-punctata	1	*Leptura rubrica*	1
Psyllobora 20-maculata	1	*Goes debilis*	1
Chilocorus bivulnerus	1	*Hæmonia nigricornis*	1
Hyperaspis undulata	1	*Anomæa laticlavia*	1
Hyperaspis gemina	1	*Cryptocephalus guttulatus*	1
Hister subrotundus	2	*Colaspis* sp	1
Hister sp	1	*Diabrotica 12-punctata*	5
Platysoma lecontei	1	*Diabrotica vittata*	1
Saprinus sphæroides	2	*Diabrotica longicornis*	1
Ips fasciatus	25	*Systena frontalis*	1
Drasterius dorsalis	1	*Odontota dorsalis*	4
Chrysobothris pusilla	1	*Odontota rubra*	1
Agrilus arcuatus	1	*Odontota nervosa*	1
Agrilus bilineatus	1	*Odontota quadrata*	1
Agrilus sp	2	*Cassida bivittata*	1
Plateros sp	1	*Haplandrus femoratus*	1
Chauliognathus pennsylvanicus	10	*Androchirus fuscipes*	1
Chauliognathus marginatus	2	*Mordella serval*	1
Chauliognathus americanus	1	*Mordella* sp	1
Chauliognathus sp	2	*Attelabus nigripes*	1
Podabrus frater	1	*Sitones hispidulus*	1
Clerus 4-guttatus	1	*Phytonomus punctatus*	2
Thanasimus dubius	1	*Læmosaccus plagiatus*	2
Canthon lecontei	1	*Conotrachelus nenuphar*	2
Onthophagus hecate	1	*Conotrachelus seniculus*	1

Cryptorynchus lapathi	1	*Sphenophorus* sp	1
Piazurus oculatus	2	*Calandra oryzæ*	1
Piazurus operculatus	1	*Platypus flavicornis*	3
Cœliodes acephalus	1	*Tomicus calligraphus*	1
Rhinoncus pyrrhopus	2	*Tomicus pini*	1
Baris striata	2	*Tomicus avulsus*	1
Balaninus sp	15	*Tomicus grandicollis*	2
Sphenophorus zeæ	2	*Scolytus 4-spinosus*	2

DIPTERA.

Chrysops sp	2	*Lucilia cæsar*	1
Tabanus sp	2	*Sapromyza vulgaris*	1
Syrphus sp	1		

HEMIPTERA.

Ceresa sp	1	*Euschistus* sp	1
Stictocephala sp	1	*Nezara hilaris*	1
Stictopelta tripunctata	1	*Corizus lateralis*	1
Corimelæna pulicaria	1	*Sinea diadema*	3
Euschistus spinosus	1	*Hygrotrechus* sp	1

ORTHOPTERA.

Tettigidea sp	1	*Tettix* sp	4

Vegetable food.—The vegetable food consists entirely of a few berries and seeds. No trace of any product of cultivation was found, except possibly 2 seeds of raspberry or blackberry found in 1 stomach, but these were probably wild. The only possible criticism that can be made is that the bird may distribute a few poison-ivy seeds, for 1 seed of this noxious plant was found in 1 of the stomachs.

The following fruits and seeds were identified:

Elderberry (*Sambucus canadensis*)	2	Poison ivy (*Rhus toxicodendron*)	1
Blueberry (*Vaccinium* sp.)	1	Blackberry or raspberry (*Rubus* sp.)	1
Alternate-leaved dogwood (*Cornus alternifolia*)	1	Poke berry (*Phytolacca decandra*)	2
Rough-leaved dogwood (*Cornus asperifolia*)	1	Panic grass seed (*Panicum* sp.)	2

Food of nestlings.—Among the stomachs were those of 2 broods of nestlings, and these were separately considered to discover possible differences in diet. One brood of 2 was labeled "just hatched," and the food was found to consist of grasshoppers, 52.50 per cent; bugs (Hemiptera), 32.50; and spiders, 15 per cent. The other brood of 4 was simply designated as "nestlings," with no hint as to their age. Their food consisted of grasshoppers and crickets, 66.25 per cent; flies (Diptera), 12.50 per cent; caterpillars, 17.50; and spiders, 3.75 per cent. This food does not differ essentially from that of the adults, except that the softer elements have been selected. The grasshoppers were, many of them, immature, and they entirely filled one stomach.

Summary.—The one point most open for criticism in the food of the wood pewee is that it eats too many parasitic Hymenoptera. There is no doubt that all birds which prey upon Hymenoptera at all destroy some of the useful species, but the proportion in the food of this bird is greater than in other birds whose food has been investigated. As these insects are for the most part smaller than the more common wasps and bees, it would seem natural that they should be preyed upon most by the smaller flycatchers, which very likely accounts for the fact that the wood pewee eats more of them than the kingbirds. But even so the bird does far more good than harm. The loss of the useful Hymenoptera can be condoned when it is remembered that with them the bird takes so many harmful or annoying species.

WESTERN WOOD PEWEE.

(*Myiochanes richardsoni.*)

During the breeding season the western wood pewee ranges over the western portion of the United States from the Pacific coast eastward as far as the western part of Texas, Kansas, Nebraska, and the Dakotas, and north to Alaska. In its fall migration it passes entirely beyond the southern boundary of the United States. The bird is seldom found in the forest, but rather on the edge of woods and in groves and open park country. Since the introduction of fruit growing it has taken kindly to orchards and gardens, and frequently builds its nest in fruit trees. Like its eastern relative, *virens*, it builds in the open upon the branch of a tree, instead of in a hollow limb or under some overhanging projection, as do so many other flycatchers. Like *virens* it prefers an orchard or grove where insects abound and the trees offer a number of dead twigs to serve as lookouts from which to sally forth to catch insects.

The writer once observed a pewee flying forth for insects from one of these perches, and noted the number caught in three minutes. In the first minute 7 were taken, in the second 5, and in the third 6, or 18 in three minutes. These observations were made at 10 a. m., when the air was warm and many insects were on the wing. At 9 a. m. the next day the same perch was again watched, and 17 captures were noted in 8 minutes. This morning was much cooler than the previous one and fewer insects were abroad. The mean of these two observations is 4 insects per minute, and if this rate is kept up for even 10 hours a day, the total is 2,400 insects. It seems hardly possible that one bird can eat so many unless they are very small, but this bird is rarely seen when it is not hunting. When there are young in the nest to feed, the havoc among the insects of that immediate vicinity must be something enormous.

The western wood pewee remains on its northern range only about six months in the year, but fortunately that is the season when insects

are most numerous, and the number that are annually destroyed by this species alone is almost beyond calculation.

In the investigation of this bird's diet there were 174 stomachs available for study. They were collected in 8 States, though most of them were taken in California, and are fairly well distributed over the six months from April to September. The food is made up of 99.93 per cent of animal matter and 0.07 per cent of vegetable.

Animal food.—Beetles, in the food of the western wood pewee, amount to 5.44 per cent, and were contained in 73 stomachs. Of these, ladybird beetles (Coccinellidæ) are 0.26 per cent, and predaceous ground beetles (Carabidæ) are 0.69 per cent, or in all, 0.95 per cent; that is, less than 1 per cent of useful beetles. The rest belong to harmful families, though no special pest was noted.

Hymenoptera (wasps and bees) are evidently very inviting food for the pewee. They are eaten in every month of the bird's stay north and a goodly quantity in each. They amount to 39.81 per cent of the food of the season (April to September), and were found in 107 stomachs, of which 17 contained no other food. Parasitic species were noted in 8 stomachs and ants in 10. No trace of a honeybee was found. Maj. Bendire quotes Mr. F. Stevens as saying of this species:

> I have known apiarists to be compelled to shoot a great many to protect their bees; one in San Diego County told me that he shot several hundred in a season. They capture both workers and drones, and I have examined many stomachs which had stings sticking in them.[1]

It would seem that conditions must have been very exceptional to cause such a destruction of honeybees, for the writer has never yet heard any complaints against the bird on this score and the stomachs contain no honeybees.

Diptera (flies) are the largest item of this pewee's food. They are eaten in every month of the bird's stay in the north and form a high percentage in all but one. They amount to 44.25 per cent of the food, which is the highest record for this item in the food of any one of the 17 flycatchers under consideration. This bird is well entitled to the name, for it certainly does catch flies, and 30 of the 162 stomachs were entirely filled with them. They were so much broken that species could not be recognized, but five families were distinguished. These were the horseflies (Tabanidæ), the snipe flies (Leptidæ), the crane flies (Tipulidæ), the robber flies (Asilidæ), and the house flies (Muscidæ). Diptera and Hymenoptera together constitute 84.06 per cent of the western pewee's food.

Hemiptera (bugs) are apparently not to the taste of this pewee. They were eaten only in the months from June to September, and amounted to but 1.79 per cent of the food. They were contained in 39 stomachs, and consisted of such families as stinkbugs, leaf hoppers, tree hoppers, and negro bugs, with probably others indeterminable.

[1] Life Histories of North American Birds, II, p. 292, 1895.

Orthoptera (grasshoppers and crickets) are conspicuously absent from the food of this bird. Not a trace of this order of insects was found in any of the stomachs. This is the more remarkable as grasshoppers are one of the staple articles of diet with a large number of insectivorous birds, and western flycatchers in general eat more of these insects than most other fly-catching species.

Lepidoptera (moths and caterpillars) are eaten to a somewhat greater extent than Hemiptera, though contained in a less number of stomachs, 29. They were taken in every month of the season and amounted to 5.17 per cent. Moths were found in 24 stomachs and caterpillars in 5. Dragon flies (Raphidia), lace-winged flies (Chrysopidæ), May flies (Ephemerida), white ants (Termes), and spiders, including one of the bristly jointed spiders (Solpugida), together make 3.47 per cent, and complete the quota of animal food.

The following are the insects identified in the food and the number of stomachs in which each was found:

HYMENOPTERA.

Tiphia inornata	1

COLEOPTERA.

Hippodamia ambigua	1	*Agrilus* sp	1
Hippodamia convergens	1	*Ptilinus basilis*	1
Hippodamia transverso-guttata	1	*Canthon* sp	1
Coccinella 9-notata var. *nevadica*	1	*Aphodius vittatus*	1
Coccinella californica	1	*Aphodius* sp	1
Coccinella sanguinea	1	*Gastroidea* sp	1
Hister bimaculatus	1	*Blapstinus* sp	1
Saprinus plenus	1	*Baris rubripes*	1
Carphophilus hemipterus	1	*Balaninus* sp	1
Agriotes sp	1		

ISOPTERA.

Termes sp	1

NEUROPTERA.

Raphidia sp	3	*Chrysopa* sp	1

Vegetable food.—Vegetable matter, called by courtesy food, was found in 4 stomachs. In one of these it consisted of 3 seeds of elderberries (Sambucus); in another, of a bit of fruit skin, with a trifle of rubbish; in another, of one seed of wild oats; and in the fourth, of rotten wood. It may be possible that this bird occasionally eats a little fruit, but evidently not often.

Summary.—While the western pewee inhabits orchards, it does not go there for fruit, but only in search of the insect enemies of the trees. It eats but few useful insects, and does not, as far as this investigation shows, attack any product of industry. If, under exceptional circumstances, it destroys honeybees, the occasions are so rare that the bird should not be blacklisted.

YELLOW-BELLIED FLYCATCHER.

(*Empidonax flaviventris.*)

The yellow-bellied flycatcher inhabits the northeastern United States and Eastern British America in the breeding season, but in migration occurs over most of the country east of the Rocky Mountains. It is a lover of cool, shady forests and mountains and is probably the most retiring and shy of the flycatchers. Its nest is usually built in a damp mossy crevice of rocks or on the ground, or among the upturned roots of a fallen tree, but always in a retired place and is carefully concealed. Living apart from man and his works, it does not come into contact with the farmer's crops nor his bees, so its food, like the bird itself, is interesting chiefly to the bird student.

For the study of this bird's food only 103 stomachs were available. They were collected in 11 States, the District of Columbia, Ontario, New Brunswick, and Nova Scotia. They were taken as far southwest as Texas and as far northwest as Wisconsin. They are fairly well distributed over the five months from May to September. The food was found to consist of 97.01 per cent of animal matter to 2.99 of vegetable, or practically of 97 to 3. Insects and spiders make up the animal food and small fruit and seeds the vegetable.

Animal food.—In the animal food, beetles amount to 16.53 per cent. Of these the useful species aggregate 1.91 per cent and consist of a few Carabidæ and Coccinellidæ. Most of the others are harmful, while some are neutral. Beetles were found in 65 stomachs and were eaten pretty regularly in every month. *Diabrotica vittata*, the striped squash beetle, which is such a pest on squash, cucumber, and melon vines, was found in 8 stomachs, and snout beetles, or weevils, were noted in 25. All of these are more or less injurious. In 10 stomachs were identified weevils of the genus *Balaninus*, which lay in nuts of various kinds their eggs from which are hatched those fat white grubs so common in chestnuts.

Hymenoptera amount to 46.25 per cent of the food and were found in 81 stomachs. Of these, 48 contained ants, which amounted to 13.42 per cent of the whole. Parasitic species were noted in 9 stomachs, and they made up 2.12 per cent of the contents. Hymenoptera as a whole form the largest item of food in every month. This bird is probably the greatest eater of ants of any of the flycatchers and stands near the head in the eating of Hymenoptera in general.

Hemiptera were found in 33 stomachs only, and amount to 4.16 per cent of the food. Stinkbugs were found in 9 stomachs and assassin bugs in 12, of which 10 contained a single species (*Sinea diadema*) with as many as 6 in 1 stomach. The assassin bugs, like the stinkbugs, prey upon other insects, and so are to a certain extent useful

insects, but *Sinea diadema* is said to have the bad habit of preying upon honeybees when near the hive. The yellow-bellied flycatcher does not select its bugs with the same good judgment that it shows when taking beetles, wasps, etc. Leaf hoppers and tree hoppers were the other families observed.

Diptera were contained in only 29 stomachs, but amounted to 14.89 per cent, or three and a half times as much as Hemiptera, although found in fewer stomachs. They belonged to several families, including the house fly, horsefly, and the long-legged crane fly. They were eaten in every month, but June and July showed the greatest consumption.

Lepidoptera were found in 28 stomachs, of which 4 contained the adult moths and 24 their larvæ or caterpillars. The amount for the season was 5.68 per cent. In one stomach was found a cricket's jaw, in another parts of a locust, and in a third some remains that were doubtfully referred to Orthoptera, and these were all the material found that could be assigned to Orthoptera. As the percentage was very small, it was included in miscellaneous insects, which are made up of these with a few May flies and a little unidentifiable matter, in all 0.98 per cent.

Spiders are eaten by this bird to a greater extent than by any of the other flycatchers. They amount to 8.52 per cent of the food and are taken quite regularly through the season. Beginning with 2.21 per cent in May they gradually increase to 14.28 per cent in September. Hymenoptera alone stand higher in the food of that month. With the exception of certain nestlings no other species of bird yet studied shows so high a percentage of spiders in its food, though wrens and titmice and some warblers approach it. Probably many of these were caught from their webs in mid-air. They were found in 30 stomachs—just one-third of all. In 13 stomachs they consisted of those peculiar species called "harvestmen" (Phalangida), or perhaps more commonly known as "daddy longlegs." These must have been picked from the ground or some plant, as they spin no webs.

The following insects were identified:

HYMENOPTERA.

Halictus sp.	4	*Camponotus* sp.	3
Spilomena sp.	1	*Formica fusca*	1
Cerceris sp.	1	*Hemiteles* sp.	2
Vespa maculata	1	*Cryptus* sp.	1
Chrysis sp.	1	*Thalessa* sp.	1
Myzine 6-cincta	1	*Xylonomus* sp.	1
Tiphia inornata	1	*Ophion* sp.	2
Aphænogaster sp.	1		

COLEOPTERA.

Platynus sp.	1	*Dichelonycha* sp.	1
Coptotomus interrogatus	1	*Anomala binotata*	1
Cryptopleurus vagans	1	*Paria aterrima*	1
Megilla maculata	1	*Paria* sp.	1
Hippodamia 15-maculata	1	*Diabrotica vittata*	8
Coccinella 9-punctata	1	*Cerotoma trifurcata*	1
Coccinella abdominalis	1	*Galerucella decora*	1
Anatis 15-punctata	1	*Crepidodera helxines*	1
Chilocorus bivulnerus	1	*Crepidodera cucumeris*	1
Agrilus egenus	1	*Odontota* sp.	1
Chauliognathus pennsylvanicus	1	*Sitones* sp.	2
Podabrus punctata	1	*Conotrachelus elegans*	2
Telephorus fraxini	2	*Cnemogonus lecontei*	1
Telephorus carolinus	1	*Baris ærea*	1
Canthon viridis	1	*Madarus undulatus*	1
Onthophagus sp.	2	*Balaninus uniformis*	2
Aphodius fimetarius	2	*Balaninus nasicus*	1
Aphodius inquinatus	1	*Balaninus* sp.	7
Aphodius sp.	3		

LEPIDOPTERA.

Apatura sp.	1	*Tortrix* sp.	1
Clisiocampa sp.	1		

HEMIPTERA.

Euschistus sp.	2	*Acholla multispinosa*	1
Sinea diadema	10		

Vegetable food.—The vegetable food consists of a few small fruits, none of which are of domestic varieties, a few seeds of poison ivy, some cedar foliage, some scales from a bud, and rubbish. The poison ivy is the only thing of any interest and that was found in only one stomach.

The following fruits and seeds were found in the stomachs:

Red cedar (*Juniperus virginiana*)	1	Dogwood (*Cornus* sp.)	1
Poke berry (*Phytolacca decandra*)	1	Blueberry (*Vaccinium* sp.)	1
Poison ivy (*Rhus toxicodendron*)	1	Fruit unidentified	7
Frost grape (*Vitis cordifolia*)	2	Cedar foliage	1
Rough-leaved dogwood (*Cornus asperifolia*)	1	Bud scales	1

Summary.—So retiring are its habits that the yellow-bellied flycatcher is seldom brought into contact with man, and hence its food can have only restricted economic interest. Its bill of fare includes insects of a number of species which are injurious to garden, orchard, or forest, as the striped squash beetle, several species of weevils, tent caterpillars, and leaf rollers.

THE WESTERN YELLOW-BELLIED FLYCATCHER.

(*Empidonax difficilis.*)

The western yellow-bellied flycatcher occupies the western part of the United States from the Pacific coast eastward as far as the eastern foothills of the Rockies and as far north as Alaska. It is found on its summer range about eight months of the year and in winter in Mexico. While somewhat partial to the recesses of the forests it takes kindly to the open, when other conditions suit, and since the advent of civilization it finds orchards quite to its mind as foraging grounds. Like the Richardson's pewee it prefers a bare dead twig for a perch, where it sits and watches for flying insects. Like all flycatchers it has keen eyesight, for it often sees and darts at an insect which is so far away as to be invisible to the human eye. The nest is built in various places, but usually in a covered site. A hollow tree, a bracket of a house porch, a beam under a bridge, a crevice among the roots of an overturned tree or under the overhanging banks of a stream are fair illustrations of its nesting sites.

No complaints have been lodged against this bird by the farmer or orchardist—in fact, it is too small to be able to do serious injury to farm crops, and if it ate fruit it could injure only a few of the smaller varieties. Nor has it been accused of eating honeybees, which are probably too large to serve as its prey.

For the study of the food of the western yellow-bellied flycatcher 157 stomachs were collected, mostly from California, with a few from other Western States. They were taken in the months from March to October and were very fairly distributed in time. The food was found to consist of 99.31 per cent of animal matter to 0.69 per cent of vegetable. The animal portion is made up of insects with a few spiders, while the vegetable part consists of a few seeds and some rubbish.

Animal food.—Useful beetles amount to 2.45 per cent of the food, and consist of predaceous ground beetles (Carabidæ) found in 8 stomachs and ladybird beetles (Coccinellidæ) in 24 or 16 per cent of the whole number. This would seem to indicate that this bird has a decided taste for coccinellids, though the percentage is not large. As few other birds eat so many of these useful beetles, it is to be inferred that this species selects them intentionally. It must be understood that any bird that eats beetles in California is likely to get a large number of coccinellids, even if it takes indiscriminately all beetles that come in its way, for the family is wonderfully abundant in that State. Other beetles amount to 5.94 per cent and are eaten with considerable regularity through the season. The genus *Bala-*

ninus, the nut destroyer, was found in 8 stomachs, and several other harmful species were identified.

Hymenoptera amount to 38.76 per cent, and were found in 121 stomachs, of which 7 contained no other food. They were mostly wasps and bees, though ants were contained in 19 stomachs and one was entirely filled with them. But few parasitic species were found. This is the largest item of food and is eaten in considerable quantity in every month.

Hemiptera were eaten in the months from April to September quite regularly, but not in large quantities. They were found in 53 stomachs, of which 2 contained nothing else, and amount to 8.44 per cent of the food. The families identified were stinkbugs, tree hoppers, and leaf hoppers. The 2 stomachs that contained Hemiptera alone were entirely filled with stinkbugs.

Diptera are the second largest item of food and are eaten in every month and more regularly than any other. They were found in 67 stomachs and in 5 there was nothing else. They average 31.22 per cent of the seasonal food. Most of them were in such a state as to preclude specific identification, but a few were crane flies (Tipulidæ), one a horsefly (Tabanidæ), a few Tachina flies (Tachinidæ), and one a soldier fly (Stratiomyiidæ).

Lepidoptera were found in the food of every month except March, but in July and August in very small quantities only. They consisted of adult moths in 8 stomachs and caterpillars in 31. It is worthy of mention that larvæ of the codling moth (*Carpocapsa pomonella*) were found in 3 stomachs and were probably contained in a number more but unrecognizable. It is not improbable that some of the adult moths were of this species also, but too badly mashed for identification. In all, Lepidoptera amount to 6.59 per cent of the food, and are eaten in every month except March, July, and August.

Orthoptera were found in 2 stomachs taken in August and one in September. They amount to 0.62 per cent of the food. Raphidia and a few unidentified insects make up 0.71 per cent. Spiders were found in every month but March and were contained in 20 stomachs. They amount to 4.58 per cent and complete the animal food.

The following insects were identified:

HYMENOPTERA.

Chrysis sp	1

COLEOPTERA.

Anisodactylus piceus	1	*Lina scripta*	1
Philhydrus sp	1	*Diabrotica 12-punctata*	1
Aleochara bimaculata	1	*Diabrotica soror*	1
Hippodamia 5-signata	1	*Diabrotica* sp	1
Hippodamia ambigua	3	*Monoxia sordida*	1
Hippodamia convergens	4	*Haltica bimarginata*	1
Coccinella californica	6	*Haltica tombacina*	1
Scymnus sp	1	*Epitrix* sp	1
Limonius infuscatus	1	*Eulabis rufipes*	1
Telephorus divisus	1	*Blapstinus ruficeps*	1
Leptura soror	1	*Rhynchites glastinus*	1
Leptura crassipes	1	*Sitones* sp	1
Gastroidea cyanea	2	*Balaninus* sp	8
Gastroidea sp	3		

DIPTERA.

Stratiomyia maculosa	1	*Tabanus punctifer*	1

LEPIDOPTERA.

Carpocapsa pomonella	3

Vegetable food.—Vegetable matter was found in 19 stomachs, but not all of it can be called food. In 1 stomach were a few seeds of Rubus (blackberry or raspberry), in 8 were seeds of elderberries, in 2 were skins of fruit not further identified, in 1 a seed of tar weed (Madia), and in 7 were bits of rubbish. The Rubus fruit consisted of 2 seeds which may have been wild and in any case could have but little economic importance.

Food of nestlings.—Included in the 157 stomachs discussed in the foregoing pages were those of 9 nestlings. These were separately tabulated and were found to vary somewhat from the adults in the proportions of food elements. One brood of 4, thought to be about 48 hours old, had been fed upon beetles, 0.25 per cent; flies, 16.25 per cent; leaf hoppers, 39 per cent; raphidians, 1.75 per cent; caterpillars, 6.75 per cent; and spiders, 36 per cent. The soft character of this food is noticeable. A few bits of a beetle fed to one nestling constituted the only hard element. Not even wasps or ants were found. Another brood of 3, somewhat older than the last, had been fed upon beetles, 5.67 per cent; flies, 50.33 per cent; wasps, 24.67 per cent; caterpillars, 13.67 per cent; and spiders, 5.66. Here the hard elements have been increased by the greater amount of beetles and by the introduction of wasps. Two other nestlings, supposed to be about 10 days old, had been fed with wasps and bees to the extent of 92.50 per cent, with no other animal food. Besides these there was in one stomach what appeared to be a mass of rootlets amounting to 7.50 per cent, and both stomachs contained a few gravel stones. It

is difficult to account for these last in the stomach of a flycatcher, but such strange objects are often found in nestlings' stomachs.

In a nest of these birds, built on a bracket in a porch of a house, the feeding of the young was watched for an hour. Both parents took part in the feeding, and the young were fed 24 times in the hour. As this was about the middle of the forenoon, it may fairly be considered as an average hour; at that time of year there were fully 14 hours of daylight, so it seems reasonable to infer that the nestlings were fed at least 336 times every day, or supposing that there were 3 of them, 112 times apiece. As the nest was situated in a garden and orchard, the insects eaten were taken from the very place where they would have done the most mischief.

ACADIAN FLYCATCHER.

(*Empidonax virescens.*)

The Acadian flycatcher breeds throughout the eastern portion of the United States as far north as southern New York, Michigan, and Wisconsin, and as far west as eastern Nebraska, Kansas, and Texas. It appears to extend farther north in the interior than it does in the east, for one stomach was received from Minnesota and one from Ontario. It winters beyond the southern boundary of this country. It is not domestic in its habits and prefers forests of deciduous trees to orchards or gardens. An area of second growth where the trees are not large seems to be the ideal place of residence.

For the study of its food 100 stomachs were available. They were collected in 14 States, the District of Columbia, and Canada, and from April to October. The food was found to consist of 97.05 per cent of animal matter and 2.95 per cent of vegetable.

Animal food.—Beetles are eaten to the extent of 13.76 per cent of the whole food. Of these 1.66 per cent are of the three prominently useful families (Carabidæ, Cicindelidæ, and Coccinellidæ). The others were of more or less harmful families and include such well-known pests as spotted cucumber beetle (*Diabrotica 12-punctata*), rose beetle (*Macrodactylus subspinosa*), rice weevil (*Calandra oryzæ*), and a scolytid. Beetles were found in 76 stomachs and were eaten quite regularly till October, when none were taken.

Wasps, bees, and ants amount to 39.93, or practically 40, per cent of the bird's food, and are eaten so regularly that no month's consumption falls much below the average. They were found in 76 stomachs, or 84 per cent of all, and 4 were entirely filled with them. Ants were contained in 29 stomachs and parasitic species in 13, but some of the latter may have been overlooked, owing to their broken condition. Hymenoptera as a whole are the largest item of animal food with this as well as most other flycatchers. Flies (Diptera) amount to

8.15 per cent of the food, and are not taken as regularly as Hymenoptera and in October are not eaten at all. They were noted in 39 stomachs and were the sole contents of 1. Most of them are of the housefly family, but a few long-legged crane flies were found in 5 stomachs. Bugs are eaten still less than flies. They amount to 6.03 per cent, but are not taken very regularly and not at all in October. They were contained in 29 stomachs and consisted of such families as the leaf hoppers, tree hoppers, stinkbugs, and assassin bugs.

Orthoptera were found in 1 stomach taken in Florida in April and 2 collected in Pennsylvania in September, but the percentage in each of these 3 stomachs was so great that the amount for the whole season is 6.38 per cent of the food, or more than the last item. The contents of the Florida stomach could not be determined further than that they were orthopterous, but the contents of the other 2 were identified as *Œcanthus niveus*, the snowy tree cricket, known in some places as the August bird. As these creatures are rather nocturnal in their habits and not much given to flying at any time, it is rather surprising to find that a flycatcher had nearly filled its stomach with them.

Moths, in both the adult and larval form (caterpillars), are second in importance in the animal food. They are taken pretty regularly in every month, but with some falling off in July. The amount for the whole season is 18.87 per cent. They were found in 38 stomachs, of which 31 contained caterpillars and 8 held moths; 3 contained no other food. No special pest was observed among them. A few miscellaneous insects, such as dragon flies, scorpion flies, and a few insects not identified, amount to 0.99 per cent, and have no special interest. Spiders and millepeds were eaten in moderate quantities from April to August. They amount to 2.94 per cent and complete the quota of animal food. As usual, many of them were the long-legged harvestmen or daddy longlegs.

The following insects were identified:

HYMENOPTERA.

Crabro sp	1	*Camponotus* sp	3
Cerceris sp	1	*Formica* sp	1
Myzine 6-cincta	1	*Cryptus* sp	2
Tiphia inornata	2		

COLEOPTERA.

Hippodamia 15-maculata	1	*Limonius plebejus*	1
Adalia bipunctata	1	*Anthaxia viridifrons*	1
Anatis 15-punctata	1	*Anthaxia* sp	1
Chilocorus bivulnerus	1	*Agrilus* sp	3
Brachycantha quadrillum	1	*Photinus scintillans*	1
Brachycantha ursina	1	*Chauliognathus pennsylvanicus*	1
Scymnus sp	1	*Chauliognathus marginatus*	1

Telephorus carolinus	1	*Diabrotica 12-punctata*	1
Chariessa pilosa	1	*Crepidodera helxenes*	2
Onthophagus sp	1	*Crepidodera* sp	1
Aphodius fimetarius	2	*Odontota dorsalis*	1
Aphodius inquinatus	1	*Odontota* sp	3
Dichelonycha sp	2	*Orchestes pallicornis*	1
Macrodactylus subspinosus	1	*Conotrachelus posticatus*	1
Trichius piger	1	*Cryptorhynchus parochus*	1
Leptura cordifera	1	*Cryptorhynchus apiculatus*	1
Lema 3-lineata	1	*Balaninus* sp	1
Exema conspersa	1	*Calandra oryzæ*	1
Paria sp	1	*Scolytus muticus*	1
Metachroma sp	1		

DIPTERA.

Lucilia cæsar	1

HEMIPTERA.

Euschistus sp	1

ORTHOPTERA.

Œcanthus niveus	2

MECOPTERA.

Panorpa sp	2

Vegetable food.—Fruit was found in 5 stomachs and vegetable refuse in 1. There were a few seeds of blackberries or raspberries, and these were the only things that could have been the product of cultivation. The rest was wild fruit of no economic value.

Summary.—The habits of the Acadian flycatcher do not lead it to the garden or orchard, and its food has little direct economic interest. It does not catch many useful insects and, as it does not prey upon any product of cultivation, it may well be considered as one of those species whose function is to help keep the great flood of insect life down to a level compatible with the best interests of other forms of life.

TRAILL'S AND ALDER FLYCATCHERS.

(*Empidonax trailli trailli* and *Empidonax trailli alnorum.*)

The Traill's and alder flycatchers, one or the other of the two forms, occupy in the breeding season the whole of the United States except the southeastern part south of northeastern Texas, Arkansas, and the mountains of West Virginia, and extend north into British America. In winter they retire entirely beyond the southern boundary of the United States. While the two subspecies differ in their geographical range, they agree with each other, and differ from most other flycatchers, in a preference for bushy thickets along streams rather than for more open country. Unlike most flycatchers they do not usually select a naked twig or stake for a perch, and the nest is generally built

near the ground in bushes beside the water—in willows in the central and western portions of the country and in alders in the east. No special differences in the food habits have been noticed, and as many of the stomachs used in this investigation were collected before the two forms had been clearly distinguished, it is not practicable to separate them now.

In determining the food of this species there were available 135 stomachs collected in 17 States, the District of Columbia, New Brunswick, Nova Scotia, and Ontario. California represents the farthest point west and Texas the farthest south, but the Texas bird was probably migrating. The stomachs are well distributed through the months from May to September. One was taken in October, but as its contents were somewhat exceptional it was not included in the investigation.

In the first analysis the food was found to consist of 96.05 per cent of animal matter to 3.95 of vegetable. Nearly the whole of the vegetable food was taken in August and September, and more than three-fourths of it in the latter month, just previous to and during migration.

Animal food.—Beetles of all kinds amount to 17.89 per cent. Of these a few were the useful ladybird beetles that eat plant lice and scales, but an overwhelming majority were harmful species, among which were three specimens of the notorious cotton-boll weevil (*Anthonomus grandis*) from a stomach taken in Texas, also the western spotted cucumber beetle (*Diabrotica soror*), locust leaf miner (*Odontota dorsalis*), and *Lema trilineata*. The last was the beetle that fed upon and injured the potato before the introduction of the potato beetle from Colorado. Besides these are a number of harmful weevils, including 1 scolytid or engraver. Beetles were found in 108 stomachs, and 1 was entirely filled with them. They constitute a good percentage of the food in every month, with the least in September, when vegetable food is at a maximum.

Hymenoptera are the largest item of animal food, not only in the aggregate but in every month. They are mostly in the form of wasps and bees, but there are a few of the parasitic species and some ants. They amount to 41.37 per cent of the food, a record which is exceeded by but 2 other flycatchers. Hymenoptera of all kinds were found in 93 stomachs and were the sole contents of 1.

Diptera, such as crane flies, robber flies, house flies, and dung flies, were found in 47 stomachs and were the entire contents of 4. They amount to 14.20 per cent of the food and are eaten very regularly in every month except September, when they fall to 8.05 per cent.

Hemiptera, mostly stinkbugs, but with representatives of several other families, were contained in 44 stomachs, and amount to 7.24 per cent of the food. The most interesting point connected with this item

is that the remains of chinch bugs (*Blissus leucopterus*) were found in 2 stomachs. In one 12 individuals were identified, and fragments showed that there were many more. In the other stomach they were too fragmentary to be counted, but the bulk of the remains would indicate at least as many.

Lepidoptera, that is moths and caterpillars, were found in 41 stomachs, of which 18 contained moths and 25 held caterpillars, 2 containing both. The aggregate of both is 7.73 per cent. No special pest was found among them, but practically all caterpillars are harmful.

Orthoptera, made up mostly of small grasshoppers of the genus *Tettix* and its allies and the immature forms of the larger species, amount to 3.91 per cent of the food. It is evident that most insects of this order are too large for such small birds as the present species. The fact that the smaller species of grasshoppers and partly grown young of the larger species are selected would seem to show that these insects are relished but that their size prevents them from being eaten more extensively. They were contained in 16 stomachs, 12 of which were taken in July and August, when most of the grasshopper eating was done.

A few odd insects, such as dragon flies and some ephemerids, were occasionally taken, and altogether amount to 2.77 per cent of the diet. A cattle tick was found in 1 stomach and a snail in another, both identifiable. Spiders and millepeds were eaten to the extent of 0.94 per cent and complete the animal food.

The following animal food was identified:

HYMENOPTERA.

Halticus sp	1	*Agapostemon texanus*	1

COLEOPTERA.

Cicindela sp	1	*Corymbites triundulatus*	1
Megilla maculata	1	*Agrilus* sp	1
Hippodamia convergens	2	*Brachys ovata*	1
Hippodamia 13-punctata	1	*Chauliognathus marginatus*	2
Coccinella 9-notata	3	*Podabrus* sp	1
Adalia bipunctata	3	*Telephorus fraxini*	3
Psyllobora tædata	1	*Telephorus flavipes*	1
Brachycantha ursina	1	*Telephorus bilineatus*	3
Languria mozardi	1	*Canthon simplex*	1
Dermestes caninus	1	*Onthophagus* sp	3
Hister 16-striatus	3	*Aphodius fimetarius*	9
Hister americanus	1	*Aphodius granarius*	1
Saprinus lubricus	1	*Aphodius inquinatus*	2
Ips fasciatus	3	*Dichelonycha elongata*	1
Tharops ruficornis	1	*Dichelonycha* sp	1
Delopius marginatus	1	*Diplotaxis* sp	1
Limonius sp	1	*Euphoria inda*	1

Dectes spinosus	1	*Crepidodera helxines*	1
Donacia subtilis	1	*Systena elongata*	1
Orsodachna atra	1	*Microrhopala dimidiata*	1
Lema trilineata	1	*Odontota dorsalis*	2
Cryptocephalus quadruplex	1	*Bruchus prosopis*	1
Cryptocephalus leucomelas	1	*Dircæa liturata*	1
Cryptocephalus venustus	1	*Pyrota schwarzii*	1
Cryptocephalus fulguratus	1	*Coleocerus marmoratus*	1
Pachybrachys abdominalis	1	*Sitones flavescens*	1
Monachus saponatus	1	*Dorytomus laticollis*	1
Glyptoscelis albidus	4	*Anthonomus grandis*	1
Diabrotica soror	1	*Tyloderma foveolatum*	1
Trirhabda tomentosa	1	*Rhinoncus pyrrhopus*	1
Galerucella sagittaria	1	*Pseudobaris farcta*	1
Blepharida rhois	1	*Scolytus muticus*	2
Disonycha melicollis	1		

DIPTERA.

Lestomyia sp	1

HEMIPTERA.

Tettigonia atropunctata	1	*Sinea diadema*	2
Blissus leucopterus	2		

ORTHOPTERA.

Tettix sp	2

ACARINA.

Dermacentor occidentalis	1

MOLLUSCA.

Pupa corticaria	1

Vegetable food.—The vegetable portion of the food amounts to but 3.95 per cent of the whole and was mostly eaten in September. Elderberries were found in 6 stomachs, blackberries or raspberries in 2, dogwood berries in 1, juniper berries in 1, fruit not further identified in 3, seeds unknown in 2, and rubbish in 1. The last two items were probably taken accidentally with other food.

The following fruits were identified:

Juniper berries (*Juniperus virginana*)	1	Rough-leaved dogwood (*Cornus asperifolia*)	1
Elderberries (*Sambucus canadensis*)	3	Blackberries or raspberries (*Rubus* sp.)	2
Elderberries (*Sambucus glauca*)	3		

Summary.—It is evident from the nesting habits of this species that it is not likely to injure any product of industry, and the contents of the stomachs examined corroborate this observation. The bird's function in nature then is to assist in keeping insects down to such a level of abundance as consists with the best interests of both plants and insects.

LEAST FLYCATCHER.

(*Empidonax minimus.*)

The least flycatcher is one of the smallest of the group and one of the most domestic, though, owing to its unobtrusive habits, it is not so well known as the noisier phœbes and kingbirds. In its breeding season it is found over the eastern portion of the United States and Canada as far west as the Rocky Mountains and in a few cases as far south as Texas and North Carolina. It frequents the open country and prefers orchards and the vicinity of buildings to thick woods. When not molested by the English sparrow, it finds congenial surroundings in villages and the suburbs of larger towns. Orchard trees, or the shade trees on lawns, afford nesting sites quite to its taste, for as a usual thing it does not build very high. It is a typical flycatcher in food habits, but like most others of the family it does not take all of its food upon the wing. The writer has seen one scrambling about on the trunk of a tree and catching insects from the bark like a creeper.

For the determination of the food of the least flycatcher 177 stomachs were available. They were collected from 13 States, the District of Columbia, Ontario, and Nova Scotia, and were taken within the months from April to September. They are fairly evenly distributed through the 6 months, but fewer were taken in April and more in May. The food consisted of 97.83 per cent of animal matter and 2.17 of vegetable.

Animal food.—Useful beetles, in this case mostly ladybird beetles (Coccinellidæ) with a few predaceous ground beetles (Carabidæ), amount to 1.41 per cent. They were eaten in every month except June, the most in September. Coccinellidæ appeared in 25 stomachs, only 3 families (Chrysomelidæ, Scarabæidæ, and weevils) being found in more and these not in many more. As this family is not especially abundant in the eastern part of the country, it is hard to explain how the bird gets so many unless it seeks for them. The aggregate in bulk does not appear large, but a good many individuals are taken, and 10 species were identified. Carabidæ were found in 13 stomachs. Beetles belonging to various families, but all harmful, amount to 19.94 per cent. Among these are some rather noted pests. The cotton-boll weevil (*Anthonomus grandis*) was found in 6 stomachs taken in Texas. In all, the stomachs contained 22 individual weevils. The striped squash beetle (*Diabrotica vittata*) and the 12-spotted cucumber beetle (*D. 12-punctata*) were both identified, as well as the imbricated clover weevil (*Epicærus imbricatus*) and the plum curculio (*Conotrachelus nenuphar*). All of these do much damage every year.

Hymenoptera are the largest item of insect food. They are eaten steadliy and regularly during every month in which stomachs were collected. April was the month of greatest consumption and June of the least. The average for the six months is 41.10 per cent. Hymenoptera of all kinds were found in 117 stomachs. Of these, 27 contained parasitic species and 42 contained ants. Three stomachs were entirely filled with ants and 4 with other Hymenoptera. Parasitic species were eaten to the average extent of 11.66 per cent per month, but were taken very irregularly, and in June none at all were eaten. This percentage is higher than is desirable and is probably due to the small size of the bird, which leads it to select small insects for its food.

Hemiptera are eaten throughout the season, but in widely varying quantities. Beginning with 4.67 per cent in April, they increase slightly in May, and rise suddenly to 32.74 per cent in June, after which they drop to nearly their former level and so continue through the season. The average for the six months is 11.12 per cent. While a few of the larger forms, like the Pentatomidæ, are eaten, the bulk of this item is made up of Membracidæ (tree hoppers), Jassidæ (leaf hoppers), with a few Capsidæ (leaf bugs), and others of the smaller species. Most of these are probably picked from leaves, trunks, and branches of trees, though a few may be taken on the wing.

Diptera amount to 11.34 per cent of the food and are eaten with considerable regularity from April till August, when they drop suddenly to 1.50 per cent. They rally a little in September, but evidently their season ends with July. Most of them were too badly mangled for further identification, but a few were crane flies (Tipulidæ).

Orthoptera are not extensively eaten by the least flycatchers, probably because they are rather large insects, and do not as a rule visit the flycatchers' haunts. Most that were eaten belong to the Tettix group or are the young of the larger species. They begin with a fraction of 1 per cent in May and increase to August, when they attain a maximum of 9.58 per cent and then disappear. The average for the season is 2.59 per cent.

Lepidoptera, in the forms of moths and caterpillars, are eaten in every month of the season. Beginning with 0.67 per cent in April they rise gradually to 10.97 in July and do not fall much below that figure during the remainder of the season. They were found in 47 stomachs, of which 21 contained the adult moths and 28 held caterpillars. Some of the caterpillars were identified as cutworms (Noctuidæ), but no special pest was noted. The average consumption for the season was 7.27 per cent. Ephemerids found in one stomach, dragon flies found in 3, and an unidentified insect in 1, make up 0.95 per cent. One stomach was entirely filled with a large dragon

fly. Flycatchers are among the comparatively small number of birds expert enough to catch dragon flies on the wing, and these insects are too wary to be taken sitting. Spiders are eaten to a small extent in every month in the season. In June, which was the month of maximum consumption, they amounted to 6.26 per cent, and for the season they reached 2.11 per cent. These complete the animal food.

The following insects were identified:

HYMENOPTERA.

Tiphia inornata	1	*Ophion* sp	1
Camponotus pennsylvanicus	2	*Chelonus* sp	1

COLEOPTERA.

Agonoderus sp	1	*Lina scripta*	1
Harpalus pennsylvanicus	1	*Gonioctena pallida*	1
Anisodactylus rusticus	1	*Diabrotica 12-punctata*	1
Anisodactylus baltimorensis	1	*Diabrotica balteata*	1
Cymbiodyta fimbriata	1	*Diabrotica vittata*	2
Hydrobius fuscipes	1	*Disonycha glabrata*	1
Hippodamia 15-maculata	1	*Disonycha* sp	1
Hippodamia 13-punctata	1	*Haltica* sp	1
Coccinella 9-notata	2	*Crepidodera helxines*	4
Coccinella sanguinea	1	*Crepidodera* sp	3
Coccinella abdominalis	1	*Graptodera* sp	1
Coccinella sp	1	*Chætocnema* sp	1
Adalia bipunctata	5	*Odontota nervosa*	1
Anatis 15-punctata	1	*Odontota* sp	1
Anatis ocellata	1	*Coptocycla bicolor*	1
Scymnus americanus	1	*Coptocycla signifera*	1
Scymnus bruleri	1	*Cryptocephalus* sp	1
Ips fasciatus	1	*Bruchus prosopis*	2
Monocrepidius vespertinus	1	*Epicærus imbricatus*	1
Agrilus sp	3	*Otiorhynchus ligneus*	1
Chauliognathus marginatus	2	*Tanymecus confertus*	1
Chauliognathus sp	1	*Sitones tibialis*	1
Telephorus sp	2	*Phytonomus nigrirostris*	1
Atænius sp	1	*Macrops* sp	1
Aphodius fimetarius	4	*Barytychius amœnus*	1
Aphodius ruricola	4	*Endalus æratus*	1
Aphodius inquinatus	10	*Anthonomus grandis*	6
Aphodius sp	2	*Conotrachelus seniculus*	1
Dichelonycha sp	2	*Conotrachelus nenuphar*	1
Exema conspersa	2	*Ceutorhynchus* sp	1
Pachybrachys othonus	1	*Rhinoncus pyrrhopus*	1
Metachroma sp	1	*Baris ærea*	1
Colaspis brunnea	1	*Balaninus uniformis*	1
Nodonota tristis	1		

DIPTERA.

Bluebottle fly (*Lucilia cæsar*)	1

HEMIPTERA.

Brochymena sp	2	*Euura* sp	1
Sinea diadema	2		

Vegetable food.—Fruit amounts to 1.83 per cent, and consists of Rubus seeds found in 2 stomachs, elderberry seeds in 2, pokeberry seeds in 1, rough-leaved cornel in 1, and fruit skins not further identified in 4. Various seeds were contained in 6 stomachs, and rubbish in 3; altogether they amount to 0.34 per cent.

The following fruits and seeds were identified:

Yellow wood sorrel (*Oxalis stricta*)	1	Elderberries (*Sambucus canadensis*)	2
Blackberries or raspberries (*Rubus* sp.)	2	Pokeberries (*Phytolacca decandra*)	1
Rough-leaved cornel (*Cornus asperifolia*)	1	Knotweed (*Polygonum* sp.)	1
		Timothy (*Phleum pratense*)	1
		Foxtail grass (*Chætochloa* sp.)	1

Summary.—In the food of the least flycatcher there is no evidence of direct injury to the farmer or horticulturist. The bird eats no grain and practically no fruit or other product of husbandry. It must be allowed that the bird destroys more useful insects than could be wished, but the injury it does in this way is comparatively slight.

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